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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. MARCH 8, 1900. CHICAGO, ILL. NUMBER 10

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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. MARCH 8, 1900. CHICAGO, ILL. NUMBER 10

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The labor troubles at Chicago are a disturbing feature of the iron trade. With building operations suspended and nearly all the machine shops crippled or closed, the contests in the building and machinery trades present possibilities of serious curtailment of consumption, particularly if they spread in the way threatened. The issue of union control has been raised by machinists in other cities also, and the chances of trouble on similar grounds, in the foundry trade, have been known for some time. The present outlook is for a very stubborn and costly struggle. While the week has brought little actual change in the deadlock over future business in the iron trade, it has shown increasing activity in some directions Whether this is the beginning of the long awaited movement can be better told as the month wears away. There has been a better movement in Southern iron than for some time, and the first export buying in many weeks is reported, 10,000 tons of Birmingham iron being taken for the second half of the year. One 6,000-ton lot is reported, for shipment in the last quarter, at full current quotations. Along with these transactions has come news of considerable bying of Bessemer iron in England by German steel works, deliveries running through 1901. It is known also that contracts for foundry and forge iron for German works have been made in England, the deliveries extending well into next year. In general, foreign prices have held their own in the past fortnight, and in some markets in Great Britain there have been advances. Nearly all grades of pig iron are stronger there, and this condition has no slight bearing on the course of the market on this side. Sellers of both Northern and Southern irons are laying emphasis on the unsatisfactory working of furnaces due in some cases to poor coke, and there is a disposition to accent the interruptions that must come this year to a good many furnaces for repairs postponed because prices were too good to permit stopping. There are signs that some buyers are considering seriously the placing of contracts beginning in June or July and running several months, believing that concessions are more likely now than when the active season is fairly under way. But overlying all considerations bearing upon possible production or present scantiness of stocks, is the effect upon consuming interests of labor troubles and political agitation. Bessemer iron holds firmly to $24 at valley furnace. In the past week sales of 15,000 tons were made, and it is understood that large requirements of steel works for the early part of the third quarter will soon be heard from. The position of steel is unchanged, but some definite development concerning the $35 price for the third quarter may be expected soon. The consumption of finished material is proceeding at a rate that would cause large purchases for future delivery under any ordinary conditions. A heavy tonnage on order books still awaits specifications. Particularly is this true in bars, and it argues against any easing in the prices of the large producers. When this material begins to be taken out freely, it can better be decided whether prices will hold or come down for the second half of the year. Structural mills are still crowded with work; in angles some mills are now unable to promise deliveries short of fall. Plates are a trifle weaker and 2.05c Pittsburg has been touched for tank steel. Bar iron shows no change in Central and Western markets; in the East agreed prices are still being cut and Eastern manufacturers are reported to have come as far west as Pittsburg, a reversal of the long existing order. In metals tin has been sensational in the past week. At 34¾c to 35c for straits in five-ton lots, the highest price on record was reached.

PITTSBURG.

OFFICE OF *The Iron Trade Review*.
1125-1126 PARK BUILDING, March 7.

Bessemer pig iron still continues in good demand and during the past week sales aggregating 15,000 tons have been reported. This iron is for delivery within the next two months, and was sold at $24, valley. Inquiries for round lots for shipment after July 1 are said to be up. There is considerable demand for Bessemer, very low in phosphorus, but none apparently is to be had. Foundry iron is a trifle easier, and sales of about 1,000 tons of No. 2 were made, during the past few days. The plate market continues weak, and 2.05 is being done on tank plates for very large orders. The condition of this market is evidently due to the fact that most mills have succeeded in working up their orders and are after new business. Recent additions to producing capacity also have their effect. The largest producer of pipes and tubes has secured a number of large orders during the week, both foreign and domestic. Sheets continue strong. The mills not under option by the proposed consolidation have decided to adhere to the minimum fixed by the others, and 3.10c for No. 28 is the minimum at all sheet mills for standard gauge black sheets, and 75 per cent off and the usual 15 cent freight allowance is the minimum quoted for galvanized sheets. The largest steel producer received a contract in the week for a large lot of steel rails for shipment to England, and the Keystone Bridge Works is figuring on a large structural contract for the same railway company. Scrap iron is weaker in this market than for some time, and steel scrap is not as strong as the general condition of the market would seem to warrant.

PIG IRON.—With the large sales of Bessemer pig during the month of February it was not believed that March would open with a very strong demand. Just the reverse, however, seems to be the case and sales of 15,000 tons at the association prices during the first week are reported. Foundry iron, while the inquiry is good, is easier, and the foundrymen are not prone to place any large orders at the prevailing prices. Small sales of forge iron are reported and the present quotations are being well maintained. We quote as follows:

Bessemer, valley furnace	$24.00		
Bessemer, Pittsburg	24.90		
No. 1 Foundry	$23.25	to	$23.75
No. 2 Foundry	22.50	to	23.00
No. 3 Foundry	21.75	to	22.25
Gray Forge, valley furnace	21.00	to	21.25
Gray Forge, Pittsburg	21.00	to	21.25

STEEL.—The market remains quiet with continued small sales. The consumers for the most part are purchasing for immediate consumption only. Quotations remain unchanged, 4x4 billets being firm at $35 and small billets are held at $36, at mill, Pittsburg, Wheeling, or valley. There is very little doing in sheet bars and prices remain unchanged. We continue the quotation of $36, mill.

FERRO-MANGANESE.—The quotation of $125 for domestic 80 per cent is unchanged.

RAILS AND TRACK MATERIAL.—Spasmodic purchases of steel rails continue, the largest steel producer having received

an order during the past week for 60 miles of rails of the Pennsylvania Railroad section. This is by far the largest order placed since the railroads made their purchases several months back. These rails are for foreign shipment. There is brisk inquiry for track material, such as nuts and bolts, but no large contracts have as yet been closed. Our quotations follow: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—spikes, 2.50c; track bolts, square nuts, 3.60c; hexagon nuts, 3.60c to 3.85c; splice bars, 2.50c to 2.60c; links and pins, 3c to 3.10c.

SPELTER.—The spelter market recovered from its weakness, noticeable on the New York and St. Louis exchanges last week and prime Western grades are held at 4.60 to 4.65c Pittsburg.

SKELP.—There has been very little demand for this product during the past week and only small sales have been reported. The market continues easy, with grooved iron held at 2c to 2.05c. We quote grooved steel at 2.15c, sheared iron at 2.20c and sheared steel at 2.20c to 2.25c.

MUCK BARS.—The market is easier than for some time and there is little demand. Sales in the past week have been few in number and the tonnage only limited. Standard quality is quoted at $32.50 to $33, and in no case is more than the latter figure asked.

BARS.—While the manufacturers of steel bars are all firm in asking 2.25c for their product in large lots and 2.35c for small lots, and common iron bars are held at 2.15c mill, the Eastern manufacturers are underselling the Pittsburg market on the latter product, offering it for 2.10c, Pittsburg. The common iron bars sold at 2.15c valley have not been quoted less than 2.20c Pittsburg, but despite this unusual competition there seems as yet no wavering on the part of the Western mills. Refined iron bars continue strong at 2.40c. The demand for bars is good and numerous small sales are reported.

STRUCTURAL MATERIAL.—With the numerous industrial plants under construction in this district, there is a continuous demand for structural material. Local mills are figuring on office erection both in this city and elsewhere, and it is the prevailing impression that a number of large contracts will be placed by April 1. The Keystone Bridge Works will in all probability be awarded the contract for erecting the bridges to be used by the British railway, for which the Carnegie Steel Co. will furnish the rails. We quote as follows: Beams and channels, 3 to 15 inches 2.25c; 18 to 24 inches, 2.35c; tees, 2.30c; zees, 2.25c; angles, from 3 to 6 inches, 2.25c. Universal mill plates, 2.25c to 2.30c, according to delivery and size of order.

PIPES AND TUBES.—The largest producer received a number of large orders during the past few days, both foreign and domestic. The outlook is exceedingly bright for a prosperous year, and small sales are numerous. The new schedule is being favorably received, the Chicago trade having adopted it as their standard during the past few days. The New York jobbers will without doubt take a similar action, and jobbers in Boston and St. Louis are expected to follow. The discounts are based upon Pittsburg and decrease gradually in proportion to the distance. We quote the following discounts, Pittsburg: Black merchant pipe, ⅛ to ⅜ inch, 25, 10, 5 and 2½ per cent; ½ inch, 25, three 10s 5 and 2½; 1 to 4 inches, 30 and five 10s; 4½ to 12 inches inclusive, 30 and four 10s; galvanized takes 15 points less discount in the base. Screw and socket casings—2 inches, 20, 5 and 3½; 3 to 4½ inches inclusive, and 8¼ to 12½ inches inclusive, 30, two 10s and 4; inserted joints are 10 per cent higher. Iron boiler tubes—1 to 1½ inches, 20, 5 and 1; 1¾ to 2¼ inches, 20, 10 and 2½; 2¾ to 8 inches inclusive, 30, three 10s and 1½; 2½ and 9 to 13 inches inclusive, 30, 10 and 4½. Steel boiler tubes are about 5 per cent net less than iron.

PLATES.—As the big mills are still in the market for new business, the weakness in the plate market continues. Mills that were last week holding out for 2.10c for tank plates on large orders are now offering to take the business at 2.05c, and even at that low figure very little business has been reported. On smaller lots, assorted widths, the quotations are 2.10c to 2.15c. We quote shell steel at 2.20c to 2.30c; flange, 2.30c to 2.40c; fire box, 3c to 3½c.

SHEETS.—The mills included in the proposed consolidation will be closed down March 17, for the purpose of taking inventory. The four sheet concerns that refused to give options on their mills have agreed to adhere to the minimum on both black and galvanized sheets, and this move is taken as an indication that they may yet be induced to enter the consolidation. It is now positively predicted that the consolidation will be effected by April 1. The headquarters will be in Pittsburg. While 3.10c is the minimum fixed for black sheets, No. 28 gauge, one pass through cold rolls, it is doubtful if any orders can be placed at this figure, as nearly all the mills have voluntarily fixed their minimum at 3.20c. Galvanized sheets continue firm with the mills quoting a discount of 75 and the usual 15-cent freight allowance for large lots, and 70 and 10 and 70 and 10 and 5 for small lots.

OLD MATERIAL.—There has been considerable demand during the week for low phosphorus Bessemer melting stock. Very little is to be had, however, as the large mills are utilizing nearly their entire output of new melting stock. Iron scrap is a trifle weaker, with a limited demand. Our quotations follow: New basic melting stock, $26 to $29; new Bessemer melting stock, $23 to $25; basic open-hearth scrap, $25 to $28; steel rails, mixed lengths, $23 to $25; short lengths, $23 75 to $25.75; iron rails, $26 to $27; cast borings $13 to $14 gross tons; cast scrap, $18; No. 1 wrought scrap, $23 to $24, net tons; busheling scrap, $17 to $19, net tons.

COKE.—During the month of February the coke shipments from the Conellsville district amounted to 33,624 cars. On the face of it this is a falling off from the month of January. However, the average daily shipments were greater than those for the first month of the year, which shows that the ovens are being pushed to their utmost capacity to supply the demand. The railroad companies are doing their best to assist the coke producers in securing prompt shipment, and more cars are available for the transportation of coke than for some months past. The market, if market it can be really called, is very firm with sales of furnace coke reported at $4. Foundry coke is held at $3.75 to $4.25, while the prevailing market quotations on furnace coke are from $3.50 to $4.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, March 7.

The market has not been especially active in the past week, owing partly to the labor conditions, which are even more unsettled than they were a week ago. More concerns are affected by the strikes, and several machine shops are practically closed because of them, while others are running with only a partial complement of men. Some apprehension is felt that the strikes will spread to other branches of work than the machine shops and building trades, and the men have threatened to extend it not only to other trades, but to other portions of the country.

PIG IRON.—The only sale of importance of the week was one of 1,000 tons of Southern iron taken by one of the leading implement makers. Generally business has been quiet, and orders have been limited to lots of 200 tons down to carloads. Most of the local foundries, the larger ones, at least, seem to have their wants supplied for the next three months, and furnaces do not expect any large buying until these consumers come into the market for their needs for the last half of the year. At the same time the furnaces are about sold up until July 1, and some of them have large contracts for delivery later in the year. Producers are very firm, and while rumors are heard of lower prices than the schedule being made it is hard to trace them to actual transactions, and most of the low priced orders are for resold iron. Generally speaking the market is in about the same condition as a week ago. Quotations are unchanged as follows:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$20 85 @ $21 85
Local Coke Fdy. No. 1	25 00 @ 25 50	Southern No. 1 Soft	22 85 @ 23 35
Local Coke Fdy. No. 2	24 00 @ 25 00	Southern No. 2 Soft	21 85 @ 22 35
Local Coke Fdy. No. 3	23 00 @ 24 00	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	25 00 @ 25 50	Jackson Co. Silveries	31 50 @ 32 50
Local Scotch Fdy. No. 2	24 00 @ 25 00	Ohio Strong Softeners	24 00 @ 25 00
Local Scotch Fdy. No. 3	23 00 @ 24 00	Alabama Car Wheel	25 00 @ 26 00
Southern Coke No. 1	22 85 @ 23 85	Malleable Bessemer	25 00 @ 26 00
Southern Coke No. 2	21 85 @ 22 85	Coke Bessemer	25 00 @ 26 00

BARS.—The demand is quite good for both iron and steel, although no very large contracts were closed in the week. Railroads seem to be the largest buyers. No concessions are being made on prices which are unchanged at 2.30c for iron and 2.35c for steel, half extras, Chicago delivery.

CAR ORDERS.—While no large contracts for cars have been placed there were several small ones, and business of this

character is coming up every day. The demand for car material of all kinds is good, and some fair sized contracts were closed in the week.

BILLETS AND RODS.—Some business has been taken by the Southern manufacturers of steel but nothing important ha. been closed. The demand is not especially large at present Bessemer billets are quoted at $35 and sheet bars at $36, Pittsburg, with $2 added for Chicago delivery. Open-hearth rods are quoted at $65 and Bessemer at $55, at mills.

PLATES.—The demand is only fair, most of the business being from store. The market is inclined to weakness, and quotations may be made a little lower than a week ago. We quote tank steel from store 2.75c to 2.85c. Mill shipments, Chicago delivery: Tank steel 2.30c to 2.40c; shell, 2.40c to 2.50c; flange, 2.50c to 2.60c; marine, 2.65c to 2.75c; fire box, 2.85c and up, according to brand.

STRUCTURAL MATERIAL.—One order for 3,000 tons of bridge material was placed by a Western road, but aside from this business was light and was limited to small lots. Local building is almost entirely stopped by the strikes, for which there is no immediate prospect of settlement A number of large building projects are held up because of the strikes, and were it not for these sales would undoubtedly be very large. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2 40c; sheared plates 2 50c to 2.60c; universal plates, 2.50c to 2 65c; tees, 2 45c zees, 2.40c; small lots from store are quoted ¼c to ½c higher.

SHEETS.—Buyers have sounded the market thoroughly in the hope of finding weak spots, but the schedule is being lived up to in all instances, and what business is closed goes at full prices. The demand is not especially large, and sales have been confined to comparatively small lots. Quotations are made at 3 20c to 3 30c for No. 27 black, and 75 per cent off for galvanized, on mill shipments.

MERCHANT STEEL.—Labor troubles in the machine shops have shut off business locally to a very large extent, and nearly all the orders being placed come from outside towns. Not very many or very large contracts were closed last week. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3 75c; tool steel, 7c to 7 50c; special, 13.50c and upwards.

MERCHANT PIPE.—Some fairly good business was closed in the week, but the demand is not especially large, and sales are not expected to increase. The new schedule of prices went into effect March 1, with discounts as follows: Black merchant pipe, ⅛, ¼, and ⅜-inch, 25, 10 and 5 per cent; ½-inch, 25, three 10's and 4; ¾-inch, 30, four 10's and 4½; 1 to 4 inches, 30, four 10's 5 and 1½; 4½ to 12 inches, 30, three 10's and 8; galvnized, 15 points less discount in the base. Iron boiler tubes, 1 to 1½ inches, 20 and 3½; 1¾ to 2¾ inches, 20 and 10; 2¾ to 8 inches, 30, two 10's, 5 and 3; 2½ and 9 to 13 inches, 30, 10 and 1½.

WIRE AND WIRE NAILS.—The rumors of higher prices which were circulated so freely for the past two weeks caused a considerably increased demand, and sales were quite a good deal larger last week as a consequence. Jobbers are buying freely, and report good sales to retailers. The advances in prices have not materialized as yet, but may come at any time. Makers quote single car loads of wire nails at $3.53, f. o. b. Chicago, and $3 63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.38; painted barb wire, $3.98; galvanized barb wire, $4.13.

OLD MATERIAL.—Sales were not especially large last week, and did not include any noteworthy orders. The demand has been only fairly good, and is not expected to show any improvement for the present. Dealers' selling prices are about as follows, although these have been shaded in some instances:

Old iron rails, gross,	$24 00@$25 00	Country malleable	$14 00
Old steel rails, long, gr.	22 00	Iron axles, net	$27 00@28 00
Old steel rails, mixed	19 00@19 50	Cast borings, net	9 00@10 00
Relaying rails, gross	28 00@30 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	24 00@24 50	Iron axle turnings, net	14 00@15 00
Railroad forge, net	24 00	Steel axle turnings	12 00@12 50
Dealer's forge, net	16 50@17 00	Mixed country steel, gr	13 50
No. 1 cut mill, net	14 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@15 00	Heavy melting steel, gr	18 00@19 00
Railway malleable, net	15 00	Old iron splice b.r net.	26 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., March 7.

In the continued absence of ore buying in any considerable volume, the mining and vessel factors in the situation furnish the only developments. On the Marquette range the large mining companies in the Ishpeming district announced an advance in wages last week amounting to 15 cents a day to miners on contract and 10 cents to all other classes of labor. Higher wages will tend to increase the supply of iron mining labor and insure the large output for which plans are made for 1900. In the freight market the fact of interest is that with the large tonnage already engaged for ore, estimated variously from 17,000 000 to 18,500,000 tons, there are shippers who are still seeking tonnage both from the head of Lake Superior and Marquette. How the coal and grain shippers will fare, in the face of such a pre-empting of vessels for the ore trade, is a problem that is not clear to some students of the situation, particularly since many vessels are bound under their contracts to go up light.

PIG IRON.—There seems still some Bessemer available for the first half and sales of 15,000 tons are reported the past week on the $24 basis, valley. It is expected that business will soon be done for the third quarter, tentative inquiries, involving large blocks, being before the furnacemen. It is believed that the present price will be the basis of third quarter business, and that the demands of steel works promise to take up the full amount of the merchant product for the second half. The relining of important stacks is a factor which is likely to be felt before many months. Foundry iron continues quiet, and an easier feeling has resulted from concessions made in the East. There are signs that important consumers will not much longer delay making contracts that will run well to the end of the year. Just what concessions can be secured the month of March is expected to develop. We quote the Cleveland market:

Bessemer	$24 50	Valley Scotch No. 1	$23 00@23 25
No. 1 Strong Foundry	22 75@23 25	Valley Scotch No. 2	22 50@22 75
No. 2 Strong Foundry	22 25@22 75	Gray Forge, valley	21 00@21 50
No. 3 Foundry	21 50@21 75	Lake Superior Charcoal.	25 00@26 00

FINISHED MATERIAL.—A vessel to be built at Buffalo furnished a 2,200-ton contract for plates and shapes the past week, the business being closed through a local office. The plate market in general continues weak, though makers are some distance apart in prices. A Northern Ohio contract, involving shell and flange steel, was taken the past week at 2.25c, delivered, yet there are mills whose Pittsburg price on boiler steel is from $2 to $4 above this figure. On tank steel 2.10c, Pittsburg, has been shaded. Sheets are firm at the advanced prices, and some stimulus seems to have been given to buying by the closing of consolidation plans. We quote as minimum 3.10c, Pittsburg, on No. 28 black sheets. Bars are unchanged, with more than moderate activity. Occasional lots from second hands, on which specifications must be given to mills, have been offered at a slight concession, but there is no change in the price of the leading producer, which is 2.15c, valley mill. Steel bars are firm at 2.25c, Pittsburg, as a minimum, and 2 35c for small lots.

OLD MATERIAL.—The market has yielded somewhat under recent offerings and considerable material has been put upon the market of late by local dealers. We quote as follows f. o. b. Cleveland: Gross tons—old iron rails, $24 to $25; old steel rails, $19.50 to $20.50; old car wheels, $22. Net tons—No. 1 railroad wrought scrap, $20 to $21; mill scrap, $14 to $15; No. 1 machinery scrap, $16; iron axles, $26; wrought turnings, $12 to $13; cast borings, $10 to $11; grate bars, $10; stove plate, $10 to $10.50.

WIRE AND WIRE NAILS.—There is every prospect of a large spring business in both wire and nails. In the latter buying has been of good volume. We quote Cleveland deliveries to reatilers at the prices recently prevailing, no advance having been made: Wire nails, $3.45; smooth wire, $3 30; painted barb wire, $3.90; galvanized, $4.05.

CINCINNATI.

March 5.

Concerning recent developments in pig iron, Matthew Addy & Co. say: "March has opened with a very much brisker inquiry for pig iron than there was any time during February. As far as actual new business is concerned it is mainly confined to small lots for quick shipment, with every now and then a large block from some extensive consumer for long forward delivery. During the week there were some blocks of Southern iron aggregating 10,000 tons sold for shipment during the last half of the year, and in each instance the full schedule prices were obtained. Probably the most significant feature of the week's business was the sale of one block of 6,000 tons of Birmingham iron for shipment abroad during

the last quarter of the year. The foreign buyer who purchased this lot also made an offer on 15,000 tons of Birmingham foundry iron at prices that were on a parity with the present domestic prices, but the deliveries wanted could not be made. It is probable, however, that on a part of the offer the deliveries can be shoved back. This is the first export transaction of any magnitude for many months and the fact that Alabama iron is again going to Europe at the full American prices current today is most important.

"The iron masters are still struggling with unusual difficulties. Labor is excessively short and extremely independent. Temporary labor troubles or the absolute lack of labor have resulted in the stoppages of furnaces for lack of coke, limestone or ore, and this too has made at certain times the product of several furnaces irregular."

Rogers, Brown & Co. say that the past week has brought greater animation in all branches of the iron and steel industries. "Inquiries have improved and sales have increased in tonnage. There have been a few requiring suspension of shipments, but very many are urging anticipations of deliveries. There is an evident improvement in the demand for bar iron, as several rolling mills have been in the market this week. Bessemer continues scarce and very firm at $24 in the valleys. Northern mill irons are strong at $21, Northern furnaces. Coke malleables are in active request, and $23 to $24, cash furnaces, represent the transactions of the week. Charcoal irons, especially chilling grades, are in very short supply, inconveniencing many car wheel manufacturers. The severe weather has interfered with the steady operation of the furnaces generally, North and South, and the production the past week has been somewhat curtailed and irregular. One of the leading Connellsville coke producers has advanced foundry coke to $4.25, cash ovens, and the other districts are maintaining prices with ease, as the demand continues to exceed supply and the transportation facilities. Every branch of the trade seems as actively engaged as ever, giving promise of marked expansion upon the return of spring, when outdoor work can be resumed."

We quote for cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $21.75; No. 2 foundry, $20.75; No. 3 foundry, $19.25; No. 4 and gray forge, $19.75; No. 1 soft, $21.75; No. 2 soft, $20.75; Lake Superior coke No. 1, $23.25 to $23.75; Lake Superior coke No. 2, $22.25 to $22.75; Hanging Rock charcoal No. 1, $25 to $26; Jackson county silvery No. 1, $30 to $31; Standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25.50 to $26.50.

PHILADELPHIA.

March 6.

Prices on pig iron are substantially maintained by the leading furnace interests, and the demand, while perhaps increasing in volume, is still confined to small or moderate lots. The smaller interests, as in the past three or four weeks, are making concessions of from 25 to 75 cents a ton. But this does not encourage liberal buying. The scarcity of good fuel is responsible for poor working of a good many furnaces, it is reported, and the lower grades are in somewhat better supply, with concessions here that are impossible on better grades. The latter may be considered a shade firmer. Producers feel that as the buying time comes nearer, with the open season not far off, they can afford to maintain their position and not attempt to push sales. Thus the market is in a condition that would make a transition to firmer prices very easy. We quote No. 1 foundry iron at $24 to $25; No. 2X foundry, $22.50 to $23.50; No. 2 plain, $21.75 to $22.25; mill iron, $20 to $20.50. There is some activity in cast iron pipe and pipe foundries made further purchases last week but not at the figures they had hoped to secure. The steel market remains inactive, with quotations at $35.50 to $36. It is believed business could be done at $35. We still quote muck bar at $30 to $30.50, sellers' mill. There is no change in finished material. Orders keep up steadily and there is some surprise at the continually crowded condition of structural mills; bridge and building work is seemingly abundant even at top prices. Plates still show weakness, but mills are not all willing to take business at any price, which seems to be the impression some buyers entertain of the present condition. Buyers do not anticipate any trouble in getting prompt shipment for some time to come, but when withheld specifications begin to come in two months hence, it is possible that the mills will be quite unable to furnish material as wanted, in spite of the additions the past year has made to producing capacity. The sheet trade shows continued improvement, with prices firmer. Bars are in good demand, but the agreed price is not strictly kept, there being some contest between Eastern and Western mills for trade, of which the latter have always had a considerable share. We quote as follows: Best refined bar iron, 2.15c to 2.20c; tank plates, steel, 2.10c to 2.15c; angles, 2.40c to 2.50c; beams, channels and tees, 2.40c to 2.50c; sheets, Nos. 10 to 14, 2.60c to 2.70c; sheets, Nos. 18 to 20, 2.80c to 3c; sheets, Nos. 21 to 27, 3.10c to 3.20c; sheets, No. 28, 3.30c to 3.40c; choice railroad scrap, $23 to $25; No. 1 yard scrap, ordinary, $19 to $20; No. 2 light scrap, $14 to $15; machinery cast, $17 to $17.75; heavy steel scrap, $22 to $22.50; old iron rails, $25 to $27; old steel rails, $22.50 to $23; wrought turnings, $15.50 to $16; cast borings, $13.75 to $14; old car wheels, $22 to $23; iron axles, $27 to $29; steel axles, $26 to $27.

IRON MARKETS ABROAD.

British iron market reports of Feb. 23 are condensed in the following. In the past week the report has had currency in New York that Germany had bought in England the entire export capacity of furnaces for 1900 and 1901. The truth seems to be that German steel works have contracted for all the available Bessemer iron from East Coast and West Coast districts in England, shipments running through 1901, and that contracts had been made also for considerable quantities of foundry and mill irons. This reflects the condition heretofore referred to and points to strong prices for pig iron in the world's markets for the next year or two.

The situation in British markets still reflects great strength. Makers of pig iron are well sold ahead, most of them to the middle of the year and prices have a rather more pronounced upward tendency. In all finished lines great activity and firm prices are dominant characteristics. No. 3 foundry at Middlesbrough remains at $17; warrants at $16.90; Scotch warrants, Glasgow, $16.80. West Coast (Barrow) hematite warrants are $18 75. East Coast Bessemer iron is held by makers at $19.35, Middlesbrough, and some ask $19.75 and $20. In the Middlesbrough finished material market, steel rails are quoted $34.50 a gross ton; steel angles $41.25, an advance of 60 cents a ton in a week; steel ship plates, $40. At Glasgow ship plates are $41.25. Glasgow advices say that "the expectation of a break in American prices has not been verified;" that leading manufacturers there hold that an easing in quotations is not probable and that "so long as the American situation is sustained the bear position is untenable."

Manchester reports an active demand for steel with billets at $36.25 to $36.50. Steel bars are quoted $46 to $47, and boiler plates $47 a gross ton. North Staffordshire bar iron at Manchester is $50 to $51 a gross ton.

Advices from Berlin are that the demand for blooms and billets has diminished somewhat, but on the whole the prosperity of the iron trade continues unchanged. The price for bar iron has advanced and is now $52 to $53, Berlin, per metric ton. Plate mills have difficulty in getting the requisite supply of mild steel and new works are talked of. In Upper Silesia conditions are stronger. Forge iron is $20.50 to $21; Bessemer, $21 to $21.50; basic, $20.50; foundry, $23 to $24. On the Rhine and in Westphalia the basis is $1 to $2.50 higher. Girders are $38.50 to $39 a ton; open-hearth plates $49; basic steel plates, $47 to $48; wire rods, $66.

Obituary.

Samuel Severance, Sr., a leading spike and rivet manufacturer of Western Pennsylvania, died at his home in Allegheny, Pa., March 4, after a brief illness of pneumonia. He was born in Pittsburg 69 years ago, and early in life entered business with his father who was the pioneer spike and rivet manufacturer of Pittsburg. Upon the death of his father he assumed the full responsibility of the business. In addition to the Pittsburg plant, Mr. Severance operated one at Glassport, Pa.

William C. Ferguson, superintendent of construction for the Westinghouse Air Brake Co., died suddenly at his home in Pittsburg, Saturday evening, March 3, of apoplexy. He had been in the employ of the company for 17 years.

THE IRON AND STEEL STOCKS.

Fluctuations of the Week and the Year.

The table below shows the changes in the iron and steel stocks in the week ending March 5, also the high and low points for the year, as reported by Denison, Prior & Co.:

Name.	WEEK.				YEAR.					
	Open	High	Low	Close	High.			Low.		
Am. Car & Fdy	15¾	16	14¾	15⅝	18	Feb.	7	12⅝	Jan.	15
Am. Car & Fdy pr.	62	62¾	60	60⅞	66	Feb.	6	59	Jan.	29
Am. Steel & Wire..	57¼	58⅜	53⅞	55	59¾	Feb.	15	45¼	Jan.	15
AmSteel & Wire pr	92	92½	90	90	92	Feb.	5	86	Jan.	2
Am. Steel Hoop.....	43⅜	43¾	34¼	34¼	50⅜	Feb.	6	34¼	Mar.	5
Am. Steel Hoop pr	79	81	79	80	86	Feb.	6	79	Mar.	1
Am. Tin Plate.....	31½	33⅜	31¼	32	36⅜	Feb.	7	27⅜	Jan.	29
Am. Tin Plate pr..	81¾	81⅝	81¼	81⅜	84	Feb.	16	80⅜	Jan.	12
Col. Fuel & Iron...	43	45⅛	42½	44½	48½	Feb.	6	40½	Jan.	8
Federal Steel.....	52⅛	54⅛	50⅜	51⅜	57¾	Feb.	6	47¾	Jan.	11
Federal Steel pr....	73⅜	74	72	73	77⅜	Feb.	6	70¾	Jan.	10
National Steel.....	46⅜	47½	42	42¾	53¾	Feb.	6	40	Jan.	26
National Steel pr..	95	96	94	94⅜	97	Feb.	6	92	Jan.	9
Pressed Steel Car..	54⅛	54¾	54⅛	54⅜	58¾	Jan.	17	54⅛	Mar.	2
PressedSteelCar pr	86¼	86½	85	85	88½	Jan.	17	85	Mar.	2
Republic Steel	23¾	23⅞	21⅝	21⅞	27½	Feb.	6	19⅜	Jan.	15
Republic Steel pr..	67⅛	68¼	66½	66⅝	70¾	Feb.	6	64¾	Jan.	18
Tenn. Coal & Iron	93	96¼	87¾	93½	104	Feb.	2	79¼	Jan.	11

Notes.

President Lambert, of the American Steel & Wire Co., says in an interview: "The demand abroad for American manufactured steel and iron is increasing enormously. Our foreign business was never as large as it is today. We are even beginning to ship wire to South Africa. The foreign demand is so great that we have been actually compelled to raise our prices. I have before me the export sales report for February and I find that they are larger than for January, although the month was unfavorable for business and only 28 days long. We have been having the greatest difficulty to obtain freight space, but that is being remedied somewhat lately."

The Republic Iron & Steel Co. last week declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable April 20 on stock of record March 15. After the meeting an official of the company said that the earnings, after two quarterly dividends on preferred stock, were equal to 7 per cent on common stock, or a surplus on Jan. 1 of $1,994,431. It is expected that future operations on new contracts at higher prices will show greater return.

Application has been made to the New York Stock Exchange to list the National Tube Co.'s $40,000,000 common and $40,000,000 preferred stock.

It is reported that the committee appointed for the purpose has secured signatures for the full amount of the Tennessee Coal, Iron & Railroad Co. preferred necessary to insure the success of the plan to retire the preferred stock.

A director in National Steel, Tin Plate and Steel Hoop says: "It is the intention of the interests which are working in harmony in these three companies to make the properties as substantial an investment proposition, for the preferred stocks, as Lake Shore. The companies will hardly be consolidated into one, but for all business purposes they may be considered a unit now. The National Steel Co. has the ore, coke, coal and transportation facilities, and provides the material to the others which in turn supply the finished product. Those who participated in the underwriting of these companies now have a profit of 50 per cent in National Steel, 35 per cent in Steel Hoop and 17 per cent in Tin Plate. These results have made us some strong friends among bankers."

The annunal meeting of the stockholders of the National Steel Co. will be held March 20 at the main office of the company, in East Orange, N. J. Three directors are to be elected to serve five years each, and it is expected that a statement of the operations of the company for the last year will be presented.

The Park Steel Co., Pittsburg, has declared a quarterly dividend of 1¾ per cent on its preferred stock payable March 1. Transfer books closed Feb. 17, and were re-opened March 1.

M. A. HANNA & Co., Cleveland, have added to their office room and rearranged their quarters recently, now having the entire sixth floor of the Perry-Payne Bldg. The Carnegie Steel Co. and connected ore, vessel and dock interests are extending their offices also, taking in most of the seventh floor of the same building.

FOUNDRYMEN'S CONVENTION IN CHICAGO.

(Special Telegram.)

CHICAGO, March 7.—It has been decided by the executive board of the American Foundrymen's Association that the next annual convention of the association will be held in Chicago this spring, the exact date not having been set as yet. Western members of the association have been anxious to have the next convention at Chicago, and the executive board received a great many letters from Chicago foundrymen and foundry supply concerns, and as well from the mayor and officers of the board of trade and other commercial organizations, urging that it be held here. Local committees will be appointed within a short time to make arrangements for the convention, and it is already assured that a sufficient sum will be raised to meet all expenses. Announcement of the committees, as well as the date of the meeting, will be made later, as soon as these matters can be decided.

Chicago members of the American Foundrymen's Association are very much gratified at the decision and nothing will be left undone to insure a successful meeting and a good time to those who attend. It is expected that the attendance will be larger than at any previous gathering, and many foundrymen from Western States who have not attended the annual meeting heretofore will be present.

Milwaukee Core Makers' Agreement.

As a result of conferences between the Milwaukee Foundrymen's Association and Core Makers' Union No. 47, of Milwaukee, over the demands made some weeks ago, the following agreement was reached, taking effect March 1. The committee of the foundrymen consisted of C. A. Sercomb, chairman, Walter Read, Harry F. Bayley, Edwin Reynolds and Oliver W. Greenslade. Concessions were made on both sides and the spirit of the men's representatives was conciliatory throughout:

"1. On and after March 1, 1900, the minimum wages for skilled machinery core makers shall be 25 cents per hour. 2. Core makers now receiving more than twenty-five cents (25c) per hour shall not be reduced. 3. All over-time, over ten hours work per day, excepting when from accident or other cause beyond control, and not consuming more than 30 minutes, shall be paid for time and one-half. 4. A core maker entitled to receive the minimum wages must be thoroughly competent to make any core that is used in castings, able to properly mix the sand, ram and rod his cores, know when they are properly baked, and that they are complete, properly fitted, safe cores, ready for the mold. 5. The foreman or superintendent of the foundry is to be the judge as to the ability and skill of the coremaker, as to whether he is entitled to receive the minimum wages. 6. It is understood that there is nothing in this agreement that will prevent the employment of other workmen and boys to make such cores as they may be competent to make at a lower rate of wages. 7. Foreman core makers shall not be members of the core makers' union. 8. This agreement to continue and to be in force until Jan. 1, 1901, and unless 30 days previous thereto notice of a desire to change any of the conditions of this agreement be given by either party thereto, then this agreement to continue and be in force until Jan. 1, 1902. The above parties hereto pledge their best efforts to carry out this agreement in good faith with the understanding that during its life no further demands be made by either party on the other."

National Tube Co. Advances Wages.

[Special Telegram.]

PITTSBURG, March 7.—The National Tube Co. is notifying employes at its various plants today of a 10 per cent advance in the wages of all day laborers. The tonnage men will get their advance in the regular scale settlement with the Amalgamated Association. At McKeesport 4,000 employes are affected. The advance takes effect April 1. At its various plants the company employs about 20,000 men.

A NEW 36-inch blooming mill is about to be built for the Cleveland Rolling Mill plant of the American Steel & Wire Co.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER

MARCH 8, 1900.

CHICAGO THE BATTLE-GROUND.

The union machinists of Chicago have thrown down the gage in what promises to be a stubborn struggle. The issue is the unionizing of shops. With it is the demand for a nine-hour day and the wage heretofore paid for 10 hours' work. The wage question by itself would not be difficult of adjustment. We find practically no dissent among the manufacturers from the principle of prosperity wages for prosperous times. But the demand of the unions that none but union men be employed in any shop is one that the employers are strenuously resisting and ought to resist with every resource at their command.

Next to the imported boycott, the most un-American feature of the trade unionism of the country is this attempt to put a brand upon the workman who chooses to sell his labor on his own terms, uncontrolled by the regulation of any organization, national or local. Against every such workman the union would put a flaming sword at the entrance to every workshop. It would drive him forth to be a vagabond. It would crush him down and trample him under foot as one who has no right to exist. It treats every product his hands have handled as an infected thing which no one within its circle may touch with impunity. Demanding the privileges of a free country, it denies them to every man, regardless of worth or skill, who has not chosen to subscribe to its rules and put his fortunes in the hands of its walking delegates.

The Chicago machinists' strike is a strike for the control of the machine shops of that city by an organization whose members number but 4,000 out of the 10,000 machinists employed in Chicago shops. The 4,000 seek to coerce the 6,000, or so many of them as are journeymen, into joining the union under pain of losing their places; what is more, they demand that the machine shop proprietors become instruments for the execution of this sentence upon employes who are satisfactory and against whom their employers have no cause for complaint. The right of the employer to contract with workmen is superseded; likewise the right of a workman to carry out, free from molestation, a contract into which he has entered with an employer of labor.

But this is only the prelude to the programme involved in union "recognition." What would follow is comprehended in about this summary: A minimum wage, without regard to amount or character of work done; the introduction of the walking-delegate as a shop fixture; the discharge of all men not journeymen machinists, including all so-called "handy" men, who may be proficient on a special tool, and in their particular work entirely capable; the re-employment in the order in which they were discharged, of all men laid off at any time, no new men to be taken on ahead of these except in place of men discharged for sufficient cause, the union being judge of sufficiency. It would seem that the history of the disastrous engineering strike in Great Britain in 1898 had been lost on the International Association of Machinists, when it is deliberately proposed to enforce in the United States what even British masters, accustomed to trades union domination, resisted to the bitter end and resisted successfully, in that memorable struggle.

The Chicago machinery manufacturers understand, as did the members of the engineering trades in England, that recognition of the union means far more than the initial stipulations of the agreement which the union offers for signature. Piece work abolition is the next step. Then, to complete the divorcement of the wage from the idea of an equivalent rendered to the wage-payer, there follows the imposition of union restrictions calculated to give a minimum of service for a maximum of pay — artificial limitations of output, on the theory that the supply of work is constant and that the less done in a given time the farther the supply will go. British manufacturers are finding out to-day, sadly to their cost, that the supply of work is a variable factor, and that the possession of the greatest economies and the most productive machinery and labor determine its distribution in international competition. We have no quarrel with short hours or high wages, provided the former are within reason and the latter are justified by existing conditions. But there is a tendency among leaders of some branches of trades unionism that is opposed by the very nature of things. The manuactfurer who would succeed must constantly excel himself. The employe is subject to the same law. If not excelling themselves, the manufacturer and his employe must strive constantly to outdo the mediocre and the unfit around them. Whatever takes the "excelsior" spirit from proprietor or workman is working steadily for his undoing. There can be no reversal of the law of progress. The skillful and the industrious are bound to make a gap, and to widen it, between themselves and the lazy and inefficient. The building trades unions in Chicago have gone counter to this law for years. Artificial limits have been put upon the daily output of the wage earner, making it less and less, until now the edict of the union compels the worker to stop with half, in some cases one-third, a full day's work. This is one of the intolerable burdens bound upon

the building trades in Chicago, that have driven the contractors to the desperate alternative of crushing the unions, as now operated, or being themselves crushed in the attempt.

We know something of the men who have organized the Machinery Manufacturers' Association in Chicago to resist the demand of the International Association of Machinists for the control of their shops. They are not labor crushers, but men who believe in the policy of live and let live. Many of them know from experience the lot of a machinist, but they never advanced to their present positions by taking counsel of walking delegates as to the number of strokes to be given for each unit of pay, or how to limit their performance to that of the unwilling or incompetent man who worked alongside. They are not enlisted in this contest to win for the sake of winning or for pride in a position once assumed; but because they are fully alive to the momentous principle involved. The Chicago type of trades unionism involves grave dangers to industry everywhere, and it is not surprising that violence and murder are almost inseparable features of such struggles as have made that city the "bloody angle" of capital and labor.

That the strike will spread to other trades and to other cities there is little doubt. The machinists in other centers are pressing the demand for union recognition, and with it, in some instances, the abolition of piece work. Foundrymen will recognize in the Chicago machinists' programme one of the demands which the molders' union has made in a tentative and sporadic way. The union leaders have not yet in any general movement pressed union control to the front, for in it are involved the handy man, the molding machine, minimum wage, piece work and other issues, the settlement of none of which can be taken for granted. It will be a pity if the excellent outlook for this year shall be disturbed by such precipitation of questions on which the men must know that their employers are bound to resist them to the utmost. Yet if it comes, the responsibility must rest with those who prefer strife and idleness to steady employment at good wages. Friendly conference will reach common ground on questions of wages and hours, but it can be said with confidence that a united front will be presented against any such radical demand as has emptied Chicago shops.

THE CHEMIST AS A FOUNDRY FACTOR.

The discussion in our recent issues, started by Dr. Kirk's communication on foundry chemistry has brought forward a practical question, and one that must be more definitely answered than it has been thus far. Dr. Kirk attributes the disappointment of some foundries in the application of chemistry to their work, to the chemist's lack of acquaintance with foundry practice and the factors apart from the constituents of the iron, that have an important bearing upon results. He would have some provision for special preliminary training of chemists expecting to enter upon foundry work; and he suggests that there be a better understanding as to the functions of the chemist in the foundry, so that his province may be widened and his services made of greater value. Mr. West, in taking issue with Dr. Kirk, insists that the chemist's work is to be wrought out in the laboratory and that he can be of most value to the founder by making accurate determinations, and correct deductions from these, leaving to the founder, as heretofore, the handling of the problems that originate from the introduction of the charge in the cupola and that multiply as operations proceed down to the shaking out of castings. We have on file two or three contributions covering points suggested by Messrs. West and Kirk, and they will have space in our next issue. Meantime we shall be glad to have the views of others on this question that in some phases is not new, but that in others has possibilities of much valuable suggestion.

Incidentally the controversy has brought up the old issue of grading pig iron by fracture, as against grading by chemical analysis. Mr. West's proposal that the fracture experts be given an opportunity at the next convention of the American Foundrymen's Association to demonstrate the possibilities of ocular inspection is one that might yield interesting results. Leaving out any controversial feature, we suggest that much interest would be taken in some such test as Mr. West suggests, if made a part of the programme of the Chicago convention. There have been published from time to time the results of graders' work, based on visual inspection of the broken pig, and side by side analyses of the pig thus broken. But a public test, using specially selected samples, analyses of which had been made beforehand by a number of chemists, while it might not throw new light on the question—for there is practically no disagreement on the superiority of the analytic method—would bring the demonstration home to many founders who thus far have been untouched by the agitation for surer and more scientific methods.

PERSONAL.

Lloyd Booth, of Youngstown, O., the well known head of the Lloyd Booth Co. and one of the best known and best regarded manufacturers in the Central West, is seriously ill, and it is feared cannot recover.

John Griffith, superintendent of the Springfield, Ill., plant of the Republic Iron & Steel Co., was stricken with paralysis last week at San Antonio, Tex., whither he had gone for his health.

F. W. Newson, of St. Marys, Goddenham, Suffolk, England, who is connected with the engineering department of a large British railway system, was in Pittsburg last week with a view to purchasing steel rails and bridge material for 60 miles of standard gauge railroad. The rails are to be of the heavy Pennsylvania railroad type, and the bridges are to be of steel construction of the American truss type. It is said that the Carnegie Steel Co. will furnish the rails and the Keystone Bridge Co. the bridge material.

William S. McGowan, Jr., has resigned as treasurer of the Hancock Inspirator Co., of Boston, Mass., to become treasurer and general manager of the Portland Iron & Steel Co., of Portland, Me., a new company composed of a number of New England manufacturers and capitalists. The plant of the Portland Rolling Mills, at South Portland, Me., has been bought and will be equipped and put in running order.

A farewell dinner was tendered R. D. Gottlieb, by the heads of the engineering department of the Carnegie Steel Co., at the Hotel Henry, Tuesday evening, March 6. Mr. Gottlieb has resigned his position with the Carnegie Steel Co. to become superintendent of construction of the Japanese Imperial Palace, Tokio, Japan. Covers were laid for 33 guests. F. H. Kindl officiated as toastmaster. The structural iron and steel for the palace is being furnished by the Carnegie Steel Co., W. B. Scaife & Sons, and Rasner & Dinger, all of Pittsburg. Mr. Gottlieb leaves the latter part of this week for Japan and expects to remain three years.

THE Egyptian government railway has a representative in Pittsburg in the person of T. A. S. Dyer, who is inspecting the structural steel being manufactured by the Carnegie Steel Co., for six coal handling machines. The Brown Hoisting & Conveying Machine Co. has the contract from the Egyptian railway for the machines.

The Chicago Machinists' Strike.

The machinists' strike at Chicago has grown rapidly in the last week and now every shop in the city is affected. The strike was not ordered at all simultaneously, but each day some force of men was called out until now most of the Chicago shops are idle. The Chicago Association of Machinery Manufacturers, which was formed recently to combat unreasonable demands by the men, has become in the past week a very strong organization, taking in over 80 of the local machine shops, including all of the leading shops, and nearly if not quite all there are in the city. The officers of the association state that they are prepared to fight to the end, and will never submit to their shops being run by the unions, or under the International Association of Machinists' rules. The men, on the other hand, say they will not work, nor will they allow any union men to work except under the union agreement, and claim that if the strike is not settled in Chicago within a short time they will not only call out machinists all over the country, but that the strike will be extended to the railroads and will affect every branch of business. At the beginning of this week the number of men affected by the strike was between 3,000 and 4,000, the employers stating that the former and the unions claiming that the latter figure is more nearly correct. The following is the agreement submitted to the employers by the International Association of Machinists:

Form of Agreement.

AGREEMENT BETWEEN.....
and....., of the International Association of Machinists.

Date.....

1. That on and after.....the..... agree to employ only members of the International Association of Machinists in good standing on machinist's work and die and tool work.

2. Machinists shall be recognized as per constitution of subordinate lodges of the International Association of Machinists, and shall be either a general workman, a competent floor hand, lathe hand, vise hand, planer hand, shaper hand, milling machine hand, slotting machine hand, die sinker and tool maker or boring mill hand.

3. The minimum rate of wages for machinists shall be 28 cents per hour, and for die and tool work 32½ cents per hour.

4. All overtime up to 12 o'clock midnight shall be paid for at the rate of one and one-half time.

5. After 12 o'clock, and all legal holidays and Sundays, shall be paid for at the rate of double time.

6. The employment of apprentices shall be in accordance with the constitution of the International Association of Machinists.

7. Nine hours shall constitute a day's work. All time worked over nine hours shall be governed in accordance with Sections 4 and 5.

8. When necessary to reduce the force of employes on account of slackness of work, the.....Company hereby agree that employes who have been laid off will be given first opportunity for re-employment, seniority and proficiency to govern.

9. In case of a grievance arising, the..... Company agree to receive a committee of their employes to investigate and, if possible, adjust the same. If no adjustment is reached, the case shall be referred to the..... .....Company and Executive Board, District No. 8, International Association of Machinists. If no satisfactory settlement is agreed on, the whole subject-matter shall be submitted to a board of arbitration of five persons, two to be selected by.....Company, two by District No. 8, International Association of Machinists, and the four to choose a fifth arbitrator. The decision reached by this board to be binding on both parties to this agreement.

10. This agreement shall be in force until March 1, 1901.

11. Thirty days' notice shall be given prior to March 1, 1901, by one party of this agreement to the other for a renewal of the agreement or any desired change in the same.

Signed, { .....
.....

Substance of the Machinists' Demands.

Conferences have been held between the Chicago Association of Machinery Manufacturers and the International Association of Machinists several times in the week, but nothing satisfactory to either side has resulted. C. J. DeBerard, secretary of the Manufacturers' Association, has given out the following as a fair explanation of the demand made by the machinists:

1. A fixed minimum wage, irrespective of earning capacity.

2. The employment of union men exclusively, and the discharge of all non-union men now employed.

3. Granting walking delegates the freedom of our shops to take up and settle grievances.

4. Nine hours as a day's work, time and a half for all overtime, and double time for holidays.

5. That handy men, who are not competent machinists, working special tools, all of whom are denied admission to the union, must be discharged within 60 days and must seek employment other than machine shop work, or remain idle.

6. Restriction as to the engagement of apprentices, and that no one shall be apprenticed under 15 or over 21 years of age.

7. No colored men allowed to belong to the union.

8. Workmen discharged must be re-engaged in the order of their discharge before employer can put new men to work, unless the walking delegate or representative of the union agrees that the workman was discharged for cause, the union to be the sole judge as to what constitutes cause.

The employers' association, by unanimous vote, has absolutely refused to sign this agreement. Claims have been made by the union officials that at least 10 of the local machine shops have agreed to sign this agreement, but the Manufacturers' association denies this absolutely, and says that no shop has made any such agreement. The Manufacturers' association has employed counsel, and established headquarters in the Fisher Building, Chicago, and proposes to fight the demand to the utmost, realizing that only in this way can the employers retain control of their own shops and business, and of the capital invested. The association has been in communication with the National Metal Trades Association, with headquarters in New York, the Metal Manufacturers' Association of Columbus, O., and the Milwaukee Manufacturers' Association, and is receiving advice and cooperation from all of these. Other associations of similar character, appreciating that the Chicago strike is preliminary to a general engagement on the issue of union control are following developments with keenest interest.

It is stated by officers of the Manufacturers' Association that they have made no blacklist, but will run open shops, and will hire any men offering themselves, whether members of any union or not, or whether or not they have been previously employed by any other members of the Manufacturers' Association. It is stated that the great body of the men that have struck went out almost entirely because of intimidation, and not because they were union men or in sympathy with the objects of the union. Many of them, too, were under a misapprehension of the causes of the strike, thinking that it was made to secure shorter hours and larger pay, when as a matter of fact it was made solely to secure recognition of the union among Chicago shops. It has not been generally known, but it is true that Chicago shops have paid larger wages by about 10 or 15 per cent than shops in other parts of the country pay for the same class of labor. At other points 10 hours constitutes a day, as has been the rule in Chicago; but there is little doubt that even with the present high level of Chicago wages the nine-hour day would be conceded if that were all.

Up to the present time no violence has developed because of the strikes, but fears are expressed that serious troubles will be had before a settlement is reached. The men's side of the contest is being handled by President James O'Connell and Organizer Stewart Reid of the International Association of Machinists.

The Chicago Association of Machinery Manufacturers has chosen wisely in taking for its president P. W. Gates, president of the Gates Iron Works. Mr. Gates's adminsitration as president of the National Founders' Association showed him to be a man of tact and resources and well fitted for leadership. Associated with him on the executive committee are H. K. McLean, of the Link Belt Machinery Co.; W. J. Chalmers, of Fraser & Chalmers; J. J. Walser, of the Goss Printing Press Co.; R. S. Greenlee, of Greenlee Bros. & Co., and W. I. Babcock, of the Chicago Ship Building Co. The concerns in the association are among the most important machinery manufacturers in the West.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

Judging Pig Iron by Its Microstructure. [*Stahl und Eisen*, Jan. 1st.]—Some time ago an article by Mr. Glinz on the title subject was reviewed in these columns. Among other statements made there was one of importance to users of charcoal iron. Mr. Glinz claimed that it was possible to distinguish charcoal from coke iron at a glance by the use of the microscope; that, granted a like chemical composition, a radically different physical structure was a marked characteristic. Mr. E. Heyn, of the Royal Testing Bureau in Charlottenburg, takes issue on this point, and claims that the conclusions arrived at by Mr. Glinz are not justified by the facts in the case. In the first place the liquid iron in the blast furnace is a homogeneous solution. There can be no question of structural differences in it; these first appear after the iron has left the blast furnace and in the act of crystallization. Indeed the structure effects change in the iron after it is set until fairly low temperatures are reached. The real reason for any difference in the structure between charcoal and coke irons of the same chemical composition will be found in the different casting temperatures, for undoubtedly there must be a variation in the two due to differences in process, all coke being hot blast, and charcoal only warm or even cold. Mr. Glinz, in order to prove his contention, should have shown that charcoal and coke irons of identical composition can under no possible circumstances show the same structure. Until he can prove this to be the case we must necessarily draw our conclusions from the nature in which the pigs were cooled. The points to be considered would therefore be the casting temperature, the temperature of the mold, the material and dimensions of the mold. Suppose, for the purpose in hand, the last two items were identical for the charcoal and coke irons, there would then only remain the casting temperature to be considered, and this influences the formation of the crystals and the distribution of the graphite.

According to Roberts-Austin the temperature at which crystallization begins is dependent upon the chemical composition, and the size of the individual crystal upon the time allowed for its formation. Reduce the time and you obtain a series of undeveloped crystalline formations, and if the time is increased well developed plates of graphite will result, conditions, by the way, which are seen in Mr. Glinz's illustrations and show that his cooling conditions evidently were not the same. As a matter of fact the explanation of the difference may be found in the higher initial temperature of the coke iron as it leaves the furnace; the pig-molds are heated considerably as the iron flows through them, and the result is a more perfect development of the graphite. Mr. Heyn adds that one more point should deserve consideration, and that is the likelihood of a greater amount of gases being contained in coke irons. As up to date it is not possible to see occluded gases with the microscope, the point can have no special bearing upon the argument. Regarding the method of Mr. Glinz to bring out the microstructure of an iron by nickel plating the polished surface, Mr. Heyn states that Prof. Martens had long ago done the same thing, employing gold and copper for the plating medium. On the whole these plating effects are not as good as simply polishing in relief and color etching. The real value of electroplating is to be found in locating foreign bodies which behave differently under galvanic action than the carbon iron compounds. For instance, using copper ammonium chloride on a specimen, there results a species of differential chemical reaction, which, in the case of crude iron products, gives valuable clues to their constitution.

Mr. Glinz answers the above by the following: That he is not the first one who has stated that charcoal and coke iron can be distinguished at a glance; that the preparation of charcoal and coke iron is so different in details of process that difference in results may be expected, and that in these days of close investigation it is a question whether the melted iron in the blast furnace is really a simple solution or is a genuine alloy with all that this would mean. The reviewer would like to add a foot note here. Any one who has been fortunate enough to see the broken pieces of two very heavy rolls side by side, the one of charcoal and the other of coke iron, the composition and casting conditions of both practically the same, will certainly have wondered why there should be such a radical difference in the appearance of the fractured surfaces. It is this difference which allows us to readily pick out the coke iron that makes us skeptical on all the theories so far advanced, and shows that science, so far as it relates to the ultimate constitution of a single piece of iron, is not yet far enough advanced to cover all the questions asked by practice. Let us hope that some one will discover new methods of investigation which will throw light on the much mooted difference between charcoal and coke irons.

The Action of Stressess.—*Baumaterialienkunde*, No. 24, contains an interesting note on the nature of deformation produced by stresses. It has been found that materials other than iron and steel exhibit the same surface markings when strained that are seen upon polished surfaces when under similar conditions. Thus a cylinder of clay, if carefully compressed, shows a series of hair cracks similar in form and position to those of a metal test piece. A piece of bond paper, if stretched in front of a light, will show a network of straight lines; all of which shows that plastic and fibrous materials follow the laws governing granular bodies. The interesting experiments of Ewin and Rosenhain, recently published in *Nature*, are also commented upon. These scientists applied the microscope directly to specimens under tension, compression and torsion, and their conclusions were that all deformation is caused not only by a gliding of the separate granules upon each other, but also of the individual particles of each granule, thus promoting a finer crystalline structure. This sliding takes place in a number of planes parallel to each other and accounts for the roughening up of the polished surface of a test piece. The movement of the particles is not continuous, but periodic, even if the load is applied steadily. The gliding produced by tension seems to be identical with that due to compression, for the microscope is unable to distinguish between the tw.o

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A WASHINGTON special says: "The naval appropriation bill will contain a provision authorizing the Secretary of the Navy to pay $545 a ton for Krupp armor plate, if he cannot get it for less. The provision will cover the battle ships Maine, Ohio and Missouri, as well as the Pennsylvania, New Jersey and Georgia, and the three big armored cruisers. The last mentioned are those authorized a year ago. The House inserted a proviso in the appropriation, limiting the cost of armor plate to $300, and prohibiting the making of contracts for construction until contracts for armor at that price had been made. The price limit on the Maine, Ohio and Missouri is $400. The limitations in both those bills will be removed, if the House passes the bill which the Committee on Naval Affairs will report. The committee has had such a mass of data before it showing that $545 is less than other governments are paying for the Kruppized armor, that it could not, if it desired, avoid the conclusion that it is useless to think of getting it for less than that figure. Russia, it is understood, is paying $560 for Krupp armor furnished by the Carnegie company, and is also paying the freight from Pittsburg to Philadelphia. France, according to the advices received by the Navy Department, is paying $703 for that armor."

THE largest steel cars ever built were finished last week by the Pressed Steel Car Co., Pittsburg, for the Chicago, Lake Shore & Eastern Railroad. An order of 1,000 of these cars has been placed and the first consignment was shipped last week. The cars have a coke capacity of 80,000 pounds and weigh 39,000 pounds, which is about 3,000 pounds less than the average wooden car of the same capacity. One of the features of the new cars is the longitudinal hoods which run their entire length. The cars are constructed entirely of steel with the exception of the roofs which are a series of wooden doors, opened while loading. They are designed for the coal and ore trade as well as for the shipment of coke. The Philadelphia & Reading Railroad has placed another contract with the Pressed Steel Car Co. for 40 additional box cars of 60,000 pounds capacity each. They will be similar in construction to the 500 cars recently ordered by this company. The Pittsburg & Lake Erie Railroad last week ordered 150 steel coke cars, while the American Steel & Wire Co. furnished designs for 1,000 coke cars for use between its coke ovens in the Connellsville regions and its new Neville Island plant.

CONCENTRATING LAKE SUPERIOR ORE.*

BY L. M. HARDENBURGH.

The intention of this paper is merely to outline the process used in the Pewabic iron ore concentrating works. The material treated consists of fragmental iron ore carried in a sandstone. The distribution of the ore through the sandstone is fairly uniform. The fragments of ore vary in size from that of a pea up to pieces weighing a couple of hundred pounds. Occasional pockets are found which contain several tons of clean ore. The bedding of the ore in the sandstone gives the material something of the appearance of a conglomerate. There is no close contact or cementing of the ore to the containing sandstone, so that when the material is crushed the ore breaks free from the rock. On this account no middle product, that is pieces of rock with more or less ore still attached, are found. The ore being much harder and less favorable than that containing sandstone, the amount of fine ore resulting from mining, and the process of crushing, is relatively small. In the course of mining, a considerable portion of the sandstone is crushed to fine sand.

As about 20 per cent of the ore is obtained by hand picking, it is necessary to first remove the fine material before any attempt is made to remove the clean ore. This is done by dumping the ore as it comes from the mine on a grizzly with 1½-inch openings, which allows the fine material to pass through, retaining all pieces sufficiently large to be sorted. The material which passes over the grizzly is drawn on the picking table where the clean ore is picked out and carried by means of a chute to a pocket near the railroad at the lower end of the mill. At the same time any barren rock is also removed. The picking table is made from rectangular sheets of metal 12 inches wide and 48 inches long with the ends turned up, and these are carried on a sprocket chain. The whole forms a shallow traveling pan 13 feet long.

The material is carried by this to a 14x20 Blake crusher. From the crusher the material passes over a ¾-inch grizzly and into a pair of 14x24 belted rolls. In order to keep the percentage of fine ore as low as possible, the rolls are set to crush three-fourths of an inch. From the rolls the material goes to a three compartment revolving screen, 10 feet long, which gives four sizes of material, as the over size is not carried back and re-crushed. The openings in the perforated plate forming the screen are 3-16x⅞ and 1¼ inch in diameter. There are two other revolving screens used. The material passing through the 1½ inch grizzly is carried to a one compartment screen with 1¼ inch holes. The material passing over this screen goes through the rolls; that which goes through is joined by that coming from the ¾-inch grizzly under the crusher, and the whole is carried to a two compartment screen with 3-16 and ⅞-inch holes.

The material through the 3-16-inch screen is carried to the jigs by the water used in the screening, and distributed by hydraulic separators. Whatever passes the separators is not further treated. It consists almost entirely of fine sand and contains very little ore. The other sizes are carried to the jigs by water and distributed by deflecting plates. There are 18 jigs used in dressing the ore. The jigs used are made of wood and have the eccentric motion for the plunger; they are the ordinary Hortz jig. Nine jigs have three compartments, with jigs 24x34 inch, the other nine have two compartments with 20x32 inch screens. The three compartment jigs are used for the three larger sizes of material, the two compartment being used for the material through the 3-16-inch screen.

The ore and rock separates very quickly and completely. The rock has a per cent gravity of approximately 2.6, the ore 5.00. The ore is removed from the jigs by automatic side discharges. These discharges are made by cutting an opening 8 inches wide in the side of the jig down to the screen frame. This opening is provided with an adjustable plate which serves to regulate the depth of bed on the jig. Another plate is fastened on the inside of the jig and extends down into the bed and serves to hold back the rock. In discharging the ore works under this and over the jig plate. The ore as it discharges falls into a pocket of about 300 pounds capacity fastened to the side of the jig and extending above the water level. When the pocket is full, the discharge opening is closed, and a wedge-shaped door at the bottom is opened allowing the ore to run in a launder. Sufficient water follows the ore to carry it to the car at the bottom of the mill. The hutch rock from the jigs dressing the three larger sizes of material is mostly clean ore mixed with a little rock and a considerable fine sand. This is carried by launders to two finishing jigs. The hutch rock from the smaller sizes is mostly sand but carries a little ore. This being very closely sized, the most of this ore is removed by passing the material over by hydraulic operation.

Four sizes of ore are produced, the bulk being between ⅞ and ½-inch in size. The smallest size obtained from the jigs is that over a 20 mesh screen. Much of the ore from these jigs would pass through the screens were it not for the bed of ore. The hutch, as has been stated, contains mostly sand. No attempt is made to treat the slime ore.

The only serious difficulty encountered has been the conveying of the material from the screens to the jigs. Owing to the nature of the material to be conveyed, the wear on the conveying machinery was excessive; the fine sand would rapidly cut out all bearing parts. Any attempt at lubrication only intensified the difficulty. This was overcome by conveying all the material by water with a slope of 2½ inches to the foot; a very small amount of water would convey the largest sizes of material. The amount of water used is about 800 gallons per minute. A considerable portion of the water used on the jigs at the upper end of the mill is used again for the same purpose lower down. The capacity of the mill is 280 to 300 tons of crude material per day, depending on the quality. Three men and eight boys per shift are required for the operation of the mill. The power is furnished by a 12x24-inch 65 h. p. Corliss engine.

In giving this description of the mill, I have not thought it best to go into cost of dressing, or percentage of ore recovered from crude material, for the reason that the crude ore has been obtained almost entirely from opening work necessary for the future working of the deposit, and the material thus obtained has not been sufficiently uniform to make a fair estimate of the saving capacity of the mill. The drifts and tunnels in the mining work were all driven in the leaner ground, and it is only this leaner ore which had been treated up to the time the mill was closed down on account of inability to secure even a moderately full supply of mine labor. When the conditions are such as again to warrant the operation of the mill, I shall be pleased to give more detailed information as to cost of dressing, etc.

* Read at the Iron Mountain meeting of the Lake Superior Mining Institute, February, 1900.

MR. BOWRON'S VIEW OF THE OUTLOOK.

James Bowron, first vice-president and treasurer of the Tennessee Coal, Iron & Railroad Co., in a recent letter to Rogers, Brown & Co., takes the view that there will be no great change in the price of pig iron in the near future. He says in part:

"I have not believed, and still do not believe, that there is any prospect for a material change in the iron market, either upward or downward. The Tennessee Co., taking into account the requirements of the steel works at Ensley, in addition to the orders already on its books, has 488,000 tons of its product for the remainder of this year already taken up. On the basis of the present output, we will have for the remainder of the year from this date about 700,000 tons to dispose of. Deducting the engagements already specified, will leave us with 212,000 tons to put on the market. I can see no solid reason for anticipating any change in the tone of the market in a downward direction. Prices are extremely strong abroad, notwithstanding speculative fluctuations in the warrant yard, which runs up ad down the gamut while makers' prices remain practically steady. The fact is that iron is scarce and is going to become more so in the foreign markets.

"I well remember the boom in the iron trade which followed the Franco-German war in 1870. The same thing I predict will follow the Anglo-Boer war in the Transvaal. Scores of bridges will have to be rebuilt, rails relaid, water mains and pumps and winding engines reconstructed, or additional ones laid; machinery of every sort will have to be replaced, and, in fact, the whole of an active mining country will have to be

substantially re-equipped. The sacrifice of $1 per ton would today enable Alabama iron to be sold against English iron in almost any European market, and this would restore a trade of 200,000 tons per year, which, for one entire year, Alabama has dispensed with.

"Then take the fuel situation. Within the past week our company has had an application for 100,000 tons of bituminous coal from New England and 50,000 tons of coke for the Pacific. We are receiving requests for fuel from Northern States, Mexico, Spain, Italy, Australia and South America. At the present time we have none to spare, and are even refusing carload orders."

MR. LOVEJOY'S ANSWER IN THE FRICK SUIT.

The following answer to the petition of H. C. Frick has been filed by F. T. F. Lovejoy in the pending Frick-Carnegie litigation at Pittsburg:

"I, Francis T. F. Lovejoy, one of the above named defendants, in answer to the above stated bill, for myself, personally (but not as trustee for the Carnegie Steel Co., Ltd., having since the filing of said bill tendered my resignation as such trustee), do now say:

"First—Being on January 10, 1900, of the opinion and belief:

"1. That the so-called 'iron-clad agreement,' under the provisions whereof the expulsion of the plaintiff (Mr. Frick) from membership in the Carnegie Steel Co. Ltd., was sought to be accomplished, was and is, for various reasons not necessary now to be set forth, null and void and of none effect.

"2. That even if the so-called 'iron-clad agreement' were in full force and effect, yet no cause existed for the expulsion thereunder of the plaintiff from membership in the said association.

"3. That even if the so-called 'iron clad agreement' were in full force and effect, and even if a technical cause was by certain members believed to exist for the expulsion of the plaintiff from membership in the said Carnegie Steel Co., Ltd., yet, inasmuch as it was and is of vital importance to the said Carnegie Steel Co., Ltd, and to its welfare as a business association, that the plaintiff should continue his membership therein, and should continue, as in the past, to aid it in the conduct of its affairs by his counsel and advice, a meeting of all or a majority of the shareholders, including the plaintiff, should have been called, at which any differences of opinion might have been freely discussed, and probably eliminated, and,

"4. That should the plaintiff have been willing after this discussion, in the interests of harmony to withdraw from membership in the said Carnegie Steel Co., Ltd., and to sell his interest therein, justice and equity demanded that he should be paid by the said association, or by any partner or partners therein, or by any other person or persons whomsoever, purchasing his said interest in said association, such price as would either be satisfactory to said plaintiff or would represent the real value of said interest, and that he should not be compelled to sell at such a price and upon such terms of payment as the purchasers themselves might fix, without consulting with the plaintiff;

"I refused to sign, when requested so to do, the notice intended to compel, under the so-called 'iron-clad agreement,' the withdrawal of the plaintiff from membership in the said Carnegie Steel Co., Ltd., or his expulsion should he fail or refuse to assign his interest therein for a consideration virtually nominal; and upon the return to Pittsburg of the president of the Carnegie Steel Co., Ltd., on Jan. 17, 1900, I tendered my resignation from the board of managers of said association, and my resignation as the secretary thereof, which resignations were the same day accepted in my presence.

"Second—Continuing of the same opinion and belief as on Jan. 10, 1900, as set forth in sections 1, 2, 3 and 4 of the first paragraph of this, my answer, I further say:

"1. The averments of the plaintiff are true as to nearly all of my own knowledge, as to the remainder, to the best of my information and belief.

"2. I join with the plaintiff in praying that your honorable body will decree that the plaintiff was on Feb. 1, 1900, and is still, a member of and shareholder in the Carnegie Steel Co., Ltd., and as such is entitled to all the rights and privileges thereto pertaining.

"3. I pray your honorable body to declare that I am no more than a nominal defendant in these proceedings, having personally neither taken any part in nor encouraged the acts complained of by the plaintiff, and that I stand before the court with clean hands, having sought to do only what was right and just, uninfluenced by fear or favor."

TWENTY-INCH DRILL.

The Hoefer Mfg. Co., of Freeport, Ill., has added to its line of drill presses a 20-inch drill designed to meet the requirements of general machine shop work. The spindles are made of crucible steel, and counterbalanced, and are fed by means of cut racks and pinions. The spindles are equipped with ball bearings, reducing the friction to a minimum and giving greater power when larger drills are used. The raising device of the table, as seen below, is provided with a one-inch screw which is driven by two bevel gears supplied with a crank in convenient reach. This screw has a nut on which the table arm rests on both sides of the screw, thus preventing the nut from tilting and cramping the screw when a heavy weight on the table is to raised. The table can be swung out of the way of the spindle when work is to be done on the base. The table, as well as the arm, can be clamped firmly in any position desired. The base, as will be seen, is provided with T slots and is accurately planed. The greatest height of the drill is 69 inches, the greatest distance from spindle to base, 40½ inches, and from the table to the spindle, 25 inches. From the column to the center of the spindle is 10¼ inches. The table is 16 inches in diameter.

TWENTY-INCH DRILL.

This drill is manufactured in six different styles, fitted as follows, with either round or square base-level feed; wheel and lever feed; wheel, lever, self-feed and automatic stop; lever and back geared; wheel and lever and back geared; wheel, lever, self feed, automatic stop and back geared. The company also has among its recent tools, 22-inch, 23-inch and 25-inch drills.

THE ACME FUEL GAS SYSTEM.

The Acme system for the manufacture of fuel gas and its application in metallurgical operations embodies appliances by which refined petroleum is manufactured into a fixed gas purer and stronger than natural gas. The plant consists of a series of generators with connecting apparatus and pipes, and the operations are automatic. Acme gas, it is claimed, produces a more intense and more penetrating heat than natural gas. It is a light fixed gas, whch once made does not recede, carrying 3,740 parts of air to one of oil, in the fuel gas, and 4,501 parts of air to one of oil in the illuminating gas. Air will support continuously one part of oil to 2,323 parts of air; becoming heavier, or taking lessthan 2,323 parts of air it turns to vapor. In its heaviest form Acme gas carries 1,417 parts more air than is required for a fixed gas. Once made it remains gas at its original strength independent of weather or temperature.

Automatic regulation insures uniformity of condition. The inlet of air and the outlet of both air and gas are controlled to the same pressure at all times, so that the fires do not vary in conditions. The temperature can be regulated by the operator. If any number of burners are in service to the limit of the plant and all are cut off but one the plant adjust itself at once so that it only makes gas for the one burner. If the full capacity of the plant is turned on at once there will be ample supply immediately for all burners.

The views given are the plant installed by the goverment at the Washington Navy Yard. The first Acme plant was installed as experimental in the forge shop connected with the naval gun factory. This shop had been using coal for heating purposes. Experiments of 18 months with the Acme system resulted in the installation of a larger plant and the gas service was extended beyond the forge shop to crucible work, galvanizing, brazing, japanning and annealing. In the forge shop the operations range all the way from light work to heaviest welding and include the manufacture of tools, bolts, rivets, etc. The gas is also applied to the heating of large ingots. By the use of gas, as shown by the superintendent's report, the output of the forge shop was increased about 100 per cent per man. The experiments in connection with annealing have not been so extensive, but thus far they have been satisfactory in the vital matters of uniformity of heating and in complete control by the operator. Uneven heating, as is well known, is one of the fruitful causes of rejected castings in malleable work. At the New York Navy Yard the Acme system is now employed for crucibles, heavy forging, making dies, tools, bolts and rivets, galvanizing, japanning, melting iron, copper and brass, pipe bending, brazing, and soldering. It is expected also to extend its use to angle furnaces.

W. F. Steele, 2001 Park Row Bldg., New York, represents the system in the East, and in the territory west of Pittsburg T. W. Harvey, 1256 Monadnock Block, Chicago.

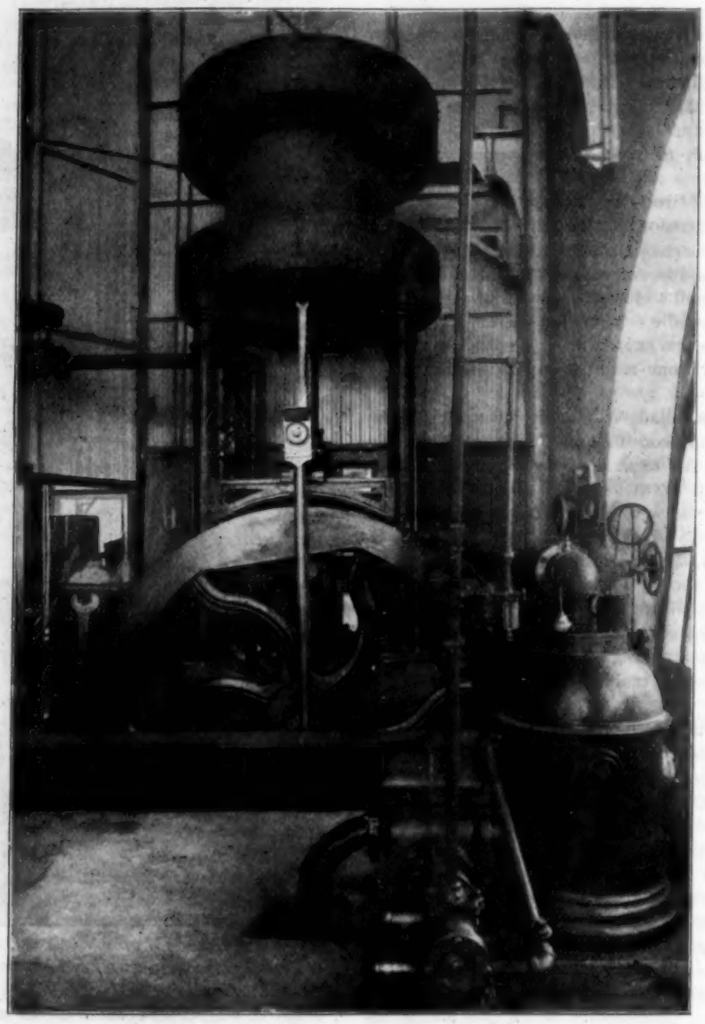


FIG. 1.—LOW PRESSURE BLOWER, ACME GAS SYSTEM, WASHINGTON NAVY YARD.

THE Carnegie Steel Co., Ltd., and all but three of the defendants in the suit commenced by H. C. Frick, received an extension of 15 days by the common pleas court of Allegheny county, last week, for the filing of their answer.

To increase its water supply at the Carrie Furnaces, Rankin, Pa., the Carnegie Steel Co. will build a tunnel to the Monongahela river. It will be 32 feet below the surface and will be 670 feet long.

A MODERN FIRE BRICK PLANT.

One of the model fire brick plants of the country is that of the W. H. Haws Fire Brick Co., Mt. Union, Huntingdon County, Pa., recently completed and in operation for about three weeks. The output consists wholly of silica brick, made from ganister, or silica rock, taken from Jack's Mountain, at the base of which the plant is located. The ganister found here is of unusually fine texture and the brick made therefrom is not given to crumbling as is sometimes the case. The plant is situated at the east end of Jack's Narrows, on the south side of the Juniata river. It is near the main line of the Pennsylvania railroad and a side track laid to the plant furnishes the necessary shipping facilities.

A cable road 1,750 feet in length has been built from the plant to the top of Jack's Mountain for carrying the ganister to the crusher. The cars are operated by gravity, a loaded car from the top of the mountain on its descent drawing up an empty one. The contents of the car are automatically dumped into the steel crusher which reduces the rock at the rate of one ton per minute. From the crusher the rock is dropped down a chute and falls close to the grinding pans. It is then placed in these pans of which there are four, as it is needed, and mixed with the necessary refractories for the manufacture of fire brick.

The wet pans are four in number and were built by Phillips McLaren & Co., Pittsburg. They have each a capacity for mixing enough clay for 4,000 brick in 8 hours, thus making the daily capacity, when the plant is in full operation, 48,000 brick. Counting in loss of time for various reasons it is estimated that the output will be easily 40,000 brick daily, or about 15,000,000 per year. The drying floor is 200x140 feet and the grinding room 40x90. Instead of hot blast, exhaust steam is used to heat the drying floor. Ten miles of 3-inch sewer pipe have been laid underneath the floor and the exhaust steam from the boilers is sufficient to keep the floor at the proper drying temperature. There are 12 kilns for burning the brick and these are located directly in front of the drying so that the dry brick have to be handled very little before being piled in the kilns.

By the location of the plant directly at the foot of the mountain from which the ganister is secured time and money are saved. The cost of transportation is done away with and the rock does not have to be mined, as it can be picked up in large bowlders and conveyed to the crusher. Being located in the center of the coal mining district, the cost of fuel is very low, as it has only to be taken a few miles from the mine to the plant. Scott Dibert, of Johnstown, is president of the company, which is incorporated for $100,000; T. C. Du Pont, of the Lorain Steel Co., is vice president; J. H. Waters, secretary and treasurer; W. H. Haws, formerly with A. J. Haws & Sons, Johnstown, brick manufacturers, is general manager.

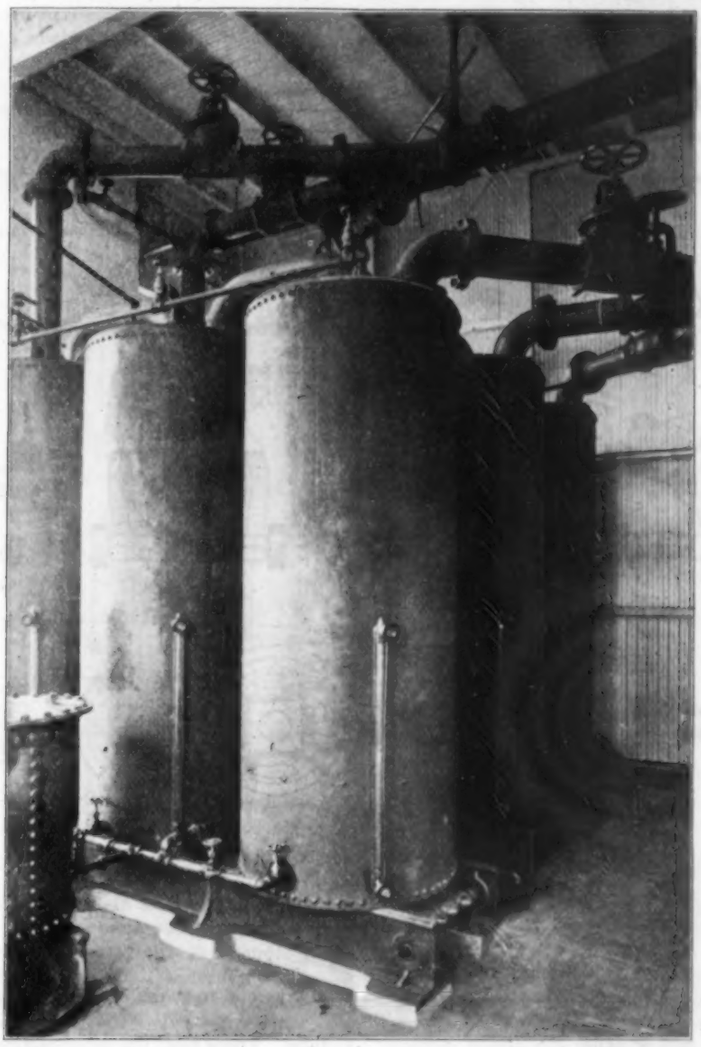


FIG. 2.—ACME GAS SYSTEM GENERATORS, WASHINGTON NAVY YARD.

The Pittsburg Coal Co., operating nearly all the railroad mines in the Pittsburg district, are preparing plans for the erection of a car and machine shop at Montour Junction, on the line of the Pittsburg & Lake Erie Railroad. The plans embrace machinery for the repair of mine and railroad cars, and equipment to be used in the numerous mines of the company will be the chief product of the machine shop. About $50,000 will be spent on the plant.

MACHINE FOR DRAWING SEAMLESS STEEL TUBES.

Some details are given in the *Engineering News*, from which we reproduce the accompanying cuts and description, of a German method of drawing seamless steel tubes. Its introduction in the United States is in the hands of Riensberger & Von der Werra, of New York. The product is a seamless steel tube having longitudinal exterior ribs to give it strength against flexure. It has been extensively used in Germany for various purposes where riveted or welded tubes or built-up hollow columns and poles have usually been employed. These tools are manufactured by the Duisberger Eisen & Stahlwerke, of Duisberg-on-the-Rhine, Germany, which has patented the construction in America. As described in the patent specifications, the process is as follows:

"Hollow bodies of malleable material, cast or otherwise produced, and having pieces connected therewith for producing the flanges or ribs, after having been pressed or stretched into flat bands in a rolling mill or under the steam hammer, are opened out at one end by hand, and by suitable devices in such manner that the band-formed piece can be drawn on a suitable strong draw bench over our improved, specially-constructed, fixed mandrel, which at its rear end has the form of the inner profile, and works in conjunction with our improved, specially-formed draw-plate, which has in its back cross section the outer profile of the beam or pillar."

Fig. 1 shows the construction of the draw-bench, and in Fig. 2 are some of the various sections of tubing which are produced by it. Fig. 3 is a rear elevation of the carriage (n, Fig 1), and Fig. 4 is a longitudinal section showing the mandrel in elevation and the draw-plate in section and also one method of locking the end of the tube being worked to the carriage. Figs. 5 and 6 are similar views to Figs. 3 and 4, showing the preferred arrangement of holding the end of the tube being drawn. Figs. 7, 8 and 9 are elevations and sections showing the preferred forms of draw plate and mandrel, of which Figs. 10 to 14 are details. Another form of draw head construction in which rolls take the usual place of the draw plate is shown in sectional elevation and plan by Fig. 15.

In Fig. 1, the flattened hollow ingot b will be seen coming from the furnace a and passing on to the mandrel, which consists of a rod or shaft c, and a long extended head s (Fig. 4). The mandrel head has its front end formed so as to constitute an opening wedge, while the rear end has a parallel exterior, as shown by the drawings. This wedge-shaped fore part, when designed to produce tubes of considerable size, consists of the pointed wedge or opener e (Fig. 7), and the stretcher or expander f. The draw plates for such forms of tubes as can be produced by a single operation, or drawing, is constructed as a long extended funnel. In the interior of this funnel, and parallel with the axis of the piece to be drawn, are raised round-shaped ribs which are gradually widened out and flattened from front to rear, and finally run into a plane surface corresponding to the walls of the finished tube. These ribs, the cross-section of which is continually altering along the longitudinal axis of the draw plate, are arranged in such a manner that the material of the walls of the tube being drawn, which has been opened and widened to some extent by the wedge point e and the expander f, is at first only slightly grooved by the forward part of the ribs on the mandrel head, and then pressed sidewise and distributed by the following broadened parts of the ribs in such a manner that the band-shaped piece being worked will, during its drawing over the mandrel and through the draw plate, only gradually assume a form similar to the rear most cross-section of the draw plate and mandrel head. By this arrangement, no further shaping of the tube takes place at the rear parts of the draw plate and mandrel head, but only a compression and finishing, or smoothing, of the already-shaped work, similar to the ordinary drawing process.

The preceding description of the action by which the tube is shaped refers to the form of draw head in which the regular

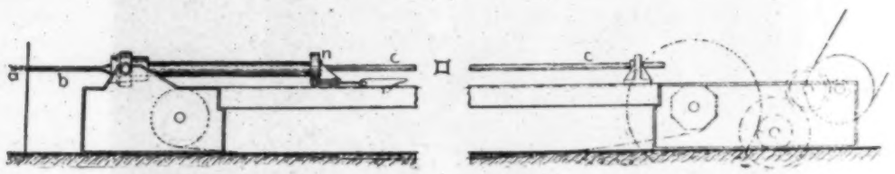


FIG. 1.—ELEVATION OF SPECIAL DRAW BENCH FOR DRAWING SEAMLESS RIBBED TUBES.

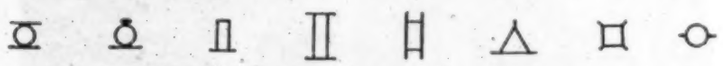


FIG. 2.—TYPICAL SECTIONS OF SEAMLESS RIBBED TUBES.

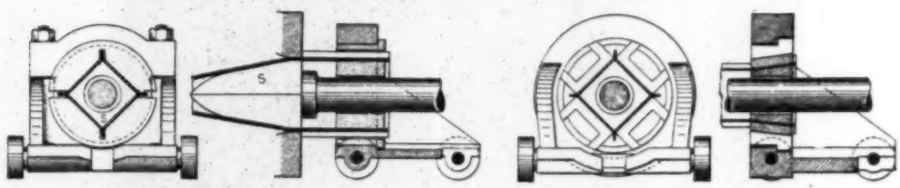


Fig. 3. Fig. 4. Fig. 5. Fig. 6.

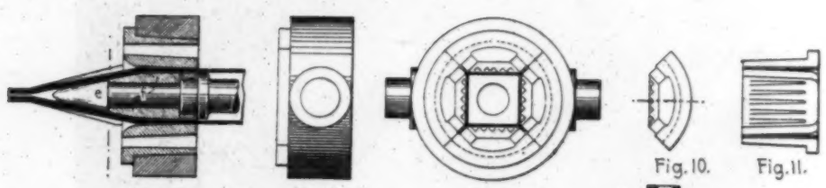


Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13. Fig 14.

FIGS. 3 TO 14.—DETAILS OF MANDRELS AND DRAW PLATES FOR DRAWING SEAMLESS RIBBED TUBES.

mandrel and draw plates are employed. Where the draw plate is replaced by rollers, as shown in Fig. 15, the action differs in a manner which will be understood from the drawing. The particular rolls shown are designed for drawing a tube of a circular cross-section, with two diametrically opposite exterior ribs, but they may be designed to draw various other sections of tube.

As manufactured by the Duisberger Eisen & Stahlwerke, the tubes are drawn from flattened hollow ingots of Siemens-Martin steel, having a breaking strength of from 57,000 pounds to 71,000 pounds per square inch, and an elongation of from 20 per cent to 30 per cent. The tubes are made in lengths up to 33 feet, and in all diameters up to about 20 inches, and the form most extensively manufactured is that with a circular cross-section with two diametrically opposite exterior ribs. Where greater lengths of tube are required than can be had with a single tube, two or more tubes are connected by special joints.

These tubes have been used in Germany for columns in bridge and building work, stanchions for ships, pipes for steam, water, gas, etc., and for poles for electric trolley wires, telegraph and telephone wires, etc. An important application of the common form of tube is to the construction of poles for carrying trolley wires for electric railways. The adaptability of the construction to ornamentation is exemplified in these poles and a valuable office is performed by the exterior ribs in strengthening the poles to resist the bending strain produced by the weight and pull of the trolley wire. A similar disposition of the ribs in the plane of the strain is employed where the tubes are used for overhead pipe lines, thus reducing the number of supports required.

The advantages claimed for these ribbed tubes as compared with ordinary seamless tubes is their lighter weight for the same flexural strength, owing to the possiblitiy of placing the ribs in the plane of the strain. As compared with riveted or built-up tubes or hollow columns, they are claimed to be much lighter in proportion to their strength, and therefore to be less expensive. It is also claimed that, being seamless, they are less liable to suffer from corrosion than riveted built up sections.

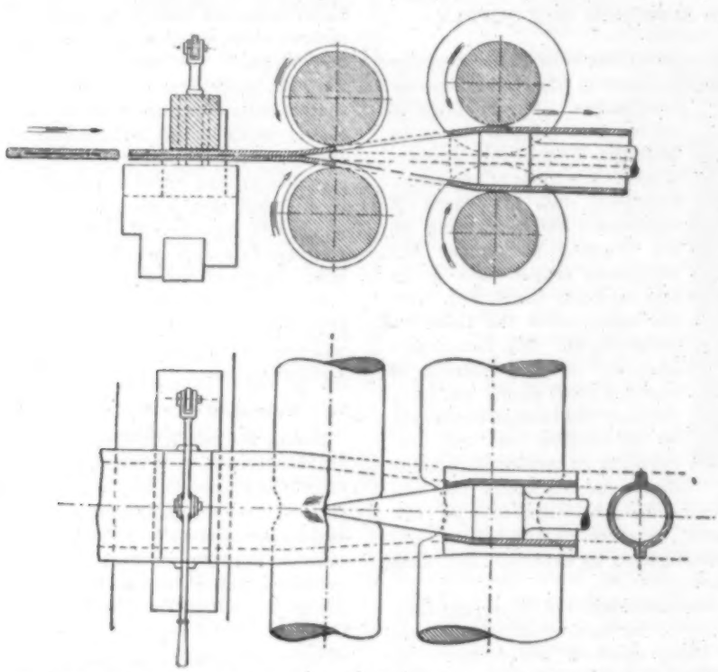


FIG. 15.—SPECIAL FORM OF ROLLER DRAW HEAD FOR DRAWING SEAMLESS RIBBED TUBES.

At a meeting of the Electrical Contractors' Association of Pittsburg, held last week, it was decided to call a general meeting of all the electrical contractors in the United States at Pittsburg, March 16.

The Pittsburg Chamber of Commerce wants to bring the next annual convention of the National Association of Manufacturers to that city.

FIRST GAS ENGINE IN BLAST FURNACE WORK.

Reference has been made in these columns to the starting up a few months ago at the John Cockarill Co.'s works at Seraing, Belgium, of large blowing engines driven directly by motors working with blast furnace gas. A recent article in the *Revue Universelle des Mines*, evidently written by an engineer connected with the Seraing works, gives some interesting data, a synopsis of which is given below:

One of the most interesting points for metallurgists in connection with the installation is that as this engine requires but little gas from the furnace, large quantities still remain available for utilisation in other motors. When the utilisation of blast furnace gas for driving blowing engines was first broached, the first difficulty to be overcome appeared to proceed from the high speed at which gas engines work. A speed of 100 to 125 revolutions per minute appeared to be a minimum even with the largest sizes of such motors as hitherto constructed, while 50 to 60 revolutions per minute represent the maximum of speed possible with modern blowing engines; but it would appear quite possible to increase this figure, either with the use of controlled valves as in the Riedler air compressors, or by the use of Lang-Horbiger valves, one or other of which arragements permits of obtaining a speed of 80 revolutions per minute, so all that has to be done is to reduce the motor's speed to this number of revolutions.

The engine on the Delamare-Debouteville "Simplex" system, giving out 600 effective h. p., comprises two horizontal cylinders arranged tandem fashion. The piston of the blowing cylinder is actuated by the piston rod of the gas cylinder, the two pistons having a stroke of 4 feet 7 inches, and the rod passing through a stuffing box, the tightness of which is perfect. The gas cylinder, 51 inches in diameter, has a single-acting piston that performs the ordinary four-period cycle. This piston directly actuates a connecting rod 14 feet 5 inches long; and the crank shaft, weighing 20 tons, is the most important part of the engine. This shaft revolves in two bearings attached to the gas cylinder by four forged steel tie-rods, which gives this engine the appearance of an hydraulic press. The crank shaft carries a fly-wheel 16 feet 5 inches in diameter, weighing 35 tons, this weight being partly supported by an outside plummer-block. The gas and blowing cylinders are tied together by cast iron cross stays, which form guides for the piston rod as in blowing engines worked by steam.

The diameter of the blowing cylinder is 5 feet 7 inches, and the volume generated by the piston at a speed of 80 evolutions per minute is 17,658 cubic feet. The air is com-

pressed to 40 cm. (16in.) of mercury, and under these conditions the motor gives out from 500 to 550 effective h. p. The inlet air valves are arranged in the covers of the blowing cylinder and on two circumferential rings, affording ample and easy passage to the air drawn in. They are steel Corliss lifting valves, 3 iches in diameter, pressed down upon their seats by spiral springs; and their working, under a pressure of 80 atmospheres, (1,176 pounds per square inch) is quite satisfactory.

The gas which supplies this engine, obtained from the general off-take of the blast furnaces, is not purified, but simply cooled down in a rectangular plate iron case, 4 feet 1 inch by 19 feet 8 inches by 19 feet 8 inches, by Korting spray producers that reduce the temperature to about 20 degrees Cent. (68 Fahr.) which is very favorable for proper working; and the working is not found to be influenced by dust or by moisture in the gas, which latter should be as cool as possible. The engine is started simply and with certainty, the first explosion being given by air carburetted with petroleum essence; but no special motor or compressed air is employed for starting, an operation which is always performed without difficulty. Thorough trials will be carried out; but the fact that a blowing engine can be worked directly with blast furnace gas is already practically demonstrated.

LIFE OF THE LAKE SUPERIOR ORE SUPPLY.

John M. Longyear, of Marquette, has been quoted recently in a newspaper interview on the future of the Lake Superior iron ranges. His holdings of timber and mineral lands in Michigan are probably more extensive than those of any single capitalist, and his years of exploration and pioneering on the Gogebic, Menominee and Marquette ranges have given him unusual familiarity with the resources of the Lake Superior region. Mr. Longyear's advocacy of the erection of iron and steel plants on Lake Superior has been an outgrowth of the relation he has sustained to mineral developments there and his desire that the largest possibilities of these natural advantages may be realized. He has published some literature on the subject, embodying the results of investigation by experts. His most recent expression is as follows:

"I have no idea that the iron ore deposits of the upper peninsula of Michigan are likely to be exhausted in the near future. The deposits now being operated will probably be exhausted in a few years but there are extensive tracts of unexplored territory which will undoubtedly yield large quantities of ore. Explorers are now at work on some of these tracts and during the coming year will probably reveal new deposits. It is doubtful, however, if the explorers will find new deposits of first-class ones rapidly enough to take the place of such deposits which are becoming exhausted, but it is safe to say that before the first-class ores of the upper peninsula become exhausted, the iron and steel makers will have turned their attention to the lower grade ores, of which there are unlimited quantities in this region. Mining operations will undoubtedly be carried on for the production of iron ore in the upper peninsula of Michigan for, at least, several generations to come.

"At present, indications strongly point to the possible early erection of steel manufacturing plants near the mines. Recent improvements in the saving of the by-products created in the process of reducing wood to charcoal make charcoal the cheapest fuel of any now in use. Immense regions near the mines are covered with a heavy growth of hardwood timber, making this a desirable point for manufacturing the ores near the point of production. This will also make it entirely practicable to use ores which would not bear the cost of transportation to distant furnaces. These ores can be had at prices that are very much less in proportion to the iron contents than the prices for the so-called first-class ores.

"With immense bodies of ore richer than those mined in Alabama, Pennsylvania, etc., lying near a cheap fuel supply, there is no likelihood of any early cessation of iron ore mining in this region. It is, however, very likely that many changes in the manner of manipulation of the iron ore and the production of iron and steel will take place in the near future. There are none of these changes, however, that seem to indicate any decrease of industrial activity in the upper peninsula. In fact, the indications all seem to point the other way. There are many other industries now gaining footholds in the upper peninsula of Michigan. Woodworking establishments are increasing and will ultimately employ more men than have been employed in the cutting of the pine timber, the end of which business is plainly in sight. All the immense timber resources of the region will be drawn upon extensively in the near future and while there are large areas of good soil which yield satisfactory returns to the agriculturist, there are other extensive areas which are undoubtedly adapted to nothing so well as the production of wood, some varieties of which grow quite rapidly. In time, some system of intelligent and practical forestry will undoubtedly be inaugurated which will insure a perpetual supply of timber for industrial purposes.

"There are many other minerals known to exist in the upper peninsula, aside from iron ore and copper, but which have heretofore had little attention. These will naturally receive more attention as the population increases and as knowledge of the natural resources develops. The clays, marbles, sandstones and other building materials have in them a basis of extensive industries. There are also extensive areas underlaid by limestones, beds of marl and other cement making material, not to speak of gold, silver, graphite, roofing slates and gannister, all of which are known to exist and have already had some attention. The numerous water powers afforded by the mountain streams, with frequent cataracts and rapids, also afford a basis for industries. Some of these powers have already been improved, but there are many others awaiting development. The region is one full of natural resources of many kinds, which will undoubtedly support an ever increasing population for hundreds of years."

February Car Orders Double Those of January.

During the month of February orders for 10,543 cars and for 185 locomotives have been noted in our news columns, against orders for 5,524 cars and 165 locomotives noted in January. Of the cars noted in February 5,310 were box, stock, furniture and refrigerator cars; 4,410 were coal, ore and gondola cars; 560 were flat cars; 300 were steel cars and 163 were for passenger and street railroad service. About 2,800 cars, or over 25 per cent, are to be built by the railroads at their own shops. Of the 185 locomotives, 18 were for export and the division of types was approximately 52 freight, 122 passenger, and 11 switching locomotives. As indicated in our January summary these orders for rolling stock show a decided advance over the January record, but the orders are still far below those placed during the five months immediately preceding January. Especially is this true of the locomotive record. It is expected that the March orders will show a considerable increase over those above noted, as at least two large orders for cars are now under consideration.—[Railroad Gazette.

A FINAL rejoinder has been received from Mr. West, in the discussion of the chemist's place in the foundry, and it will appear in our issue of next week. Mr. West replies to Dr. Kirk and makes some comment on the suggestions of Dr. Phillips.

THE Atlantic Tube Co., general offices in the Park Bldg., Pittsburg, manufacturer of standard weldless boiler tubes, has issued a price list pamphlet, giving prices revised and adopted in February. The Atlantic standard weldless boiler tubes are manufactured in sizes from 1 inch to 6 inches outside diameter, and the cold drawn weldless tubes for locomotives and for marine and stationary boilers, in sizes ranging from 1 inch to 4 inches outside diameter. Tables of weights are given for tubes of various diameters; also for upsetting ends of tubes. The company also furnishes heavy hydraulic tubes, gas and air cylinders and hollow axles, shafting and piston rods. I. W. Bollinger, Monadnock Block, Chicago, is Western agent for the company.

ANNEALING MALLEABLE CAST IRON.*

BY GEORGE C. DAVIS, EASTON, PA.

Two statements have been frequently made concerning the changes resulting from annealing, that have not attracted the attention they deserve. The first is that malleable iron gains in weight, and the second is that it expands about ⅛ inch per foot. Now the question naturally arises, Is there actually any expansion, or is it merely concretion or building up of the castings from the surrounding packing? Some thin castings were given a decarbonizing annealing in mill scale packing in a very hot oven. The results are given in table No. 1, the weights being stated in grams:

TABLE NO. 1—SHOWING GAIN IN WEIGHT.

Hard Iron.	Annealed.	Per Cent Gained.	2d Anneal.	Per Cent Gained.
40 1575	42 4900	5 81	42 5460	.13
44 8700	47.5465	5 96	47.5885	09
38 4440	41 0430	6 76	41.0885	.11

We deduce from these figures that, under these conditions, there is an averge net gain of 6.29 per cent, or allowing for loss of carbon (approximately 3.40 in this case), that there is an actual concretion of 9.69 per cent of the weight of the casting. Next a number of small castings were annealed in a packing not containing any appreciable amount of iron. Sand was the packing used, and the results are given in table No. 2:

TABLE NO. 2—SHOWING EFFECT OF ANNEALING IN SAND.

Hard Iron.	Annealed Iron.	Per Cent Loss.
72.657	70 458	3.02
85 324	81.7810	4.15
75.4924	71.0820	5.84
41.6035	39.2855	5.56

These castings were covered with a thick, soft scale, and part of the loss was due to his, while an examination showed that there had also been a partial oxidation of the carbon. The pot was a small one and the castings rather more exposed to the action of the air than they would have been in a larger pot.

For a third experiment a set of bars, each 12 inches long by 1 inch wide and of different thickness from ⅛-inch to ¾-inch were cast from the same heat. There were four bars in each set, and the results are as uniform as could be expected. I selected in each case the bar showing the nearest to the average, and the results are given in table No. 3. The first line represents the annealed bar and the second the unannealed in each case. The dimensions are given in inches:

TABLE NO. 3—SHOWING EXPANSION.

	Length.	Breadth.	Thickness.
⅛-inch Bar	11.832	1.050	.143
	11.708	1.037	.132
¼-inch Bar	11.930	1.031	.267
	11.784	1.015	.254
⅜-inch Bar	11.927	1.043	.392
	11.757	1.020	.382
½-inch Bar	12.093	1.021	.509
	11.909	1.000	.497
⅝-inch Bar	11.942	1.031	.633
	11.742	1.007	.615
¾-inch Bar	11.964	1 030	.749
	11.769	1.005	.732

In table No. 4 I have given the figures showing increase in weight and diffusion of carbon on the above bars. The iron analyzed, silicon .60, sulphur .047, and total carbon 3 23, except in the case of the ½-inch bars, which were poured from another ladle, and contained 3.18 per cent carbon.

TABLE NO. 4—SHOWING CHANGES IN WEIGHT.

	Unannealed.	Annealed.	Gain Per Cent.	Loss Carbon.	Concretion.
⅛ inch Bar..	204 9	211.6	3.27	2.90	6.17
¼-inch Bar..	377.8	384.6	1.80	1.97	3.77
⅜-inch Bar..	555.1	561.6	1.17	1.43	2.60
½-inch Bar..	735.2	740 2	.68	1.28	1.96
⅝-inch Bar..	882.5	890.1	.86	1.27	2.13
¾-inch Bar..	1068.8	1076.4	.71	1.18	1.89

An examination of these tables shows that the changes result from complex causes. Taking the extreme cases the ⅛-inch bar increased in length about one-third as much as the ¾-inch bar. The cubic contents of the ⅛-inch bar, based on the above dimensions, are 1.61 and 1.776 inches, a gain of 10.29 per cent, while the concretion was 6.17 per cent. In the ¾-inch bar we obtain 8.657 and 9.23, or an increase of 6.60 per cent, while the concretion was 1.89 per cent. Now, in the first case the increased volume appears to have been largely due to concretion, while in the second case the remaining graphitic carbon may be the cause. In the white iron practically all the carbon is in combination. During the annealing this carbide is decomposed and the carbon nearly all removed, while in the ¾-inch bar two-thirds of the original carbon remains as graphite. It should be noted that the measurements taken on the light bars cannot be so reliable as those on the heavier sections. The reason for this is the warping of the light sections during annealing. The carbon determinations were made on samples taken from a cross-section in the center of the bar.

Just what reaction occurs between the carbon of the casting and the iron oxide of packing there are not sufficient data to determine, but in all probability it is complex. We know that considerable carbon oxide escapes from the pots during annealing, and that both ferric and ferrous oxides are present in the packing. A comparison of the results in tables Nos. 1 and No. 3 shows that the concretion is greater if the annealing is done at a higher temperature. This illustrates the difficulty in making any general statement covering the case. All we can safely assert is that the carbon as it diffuses reduces the adjacent packing, which at the annealing heat welds on to the casting.

TABLE NO. 5—DIFFUSION OF SULPHUR.

	White Iron.	Annealed.		White Iron.	Annealed.
⅛-inch Bar...	.047	.072	⅝-inch Bar...	.047	.062
¼-inch Bar...	.047	.066	¾-inch Bar...	.047	.058
⅜-inch Bar ..	.047	.060	¾-inch Bar, outside....	.047	.082
½-inch Bar...	.047	.058	¾-inch Bar, inside...	.047	.046

These results show that sulphur diffuses, and, like carbon, it varies with the cross-section of the casting, other conditions being the same. That the gain in sulphur is near the surface is shown by the results on the ¾-inch bar. While the center remained unchanged, the outside sample taken 1-50 inch increased .035. It will probably be a surprise to many that there is so large a gain in this element. Much of the packing is made from mill scale, from common grades of wrought iron. This was originally made from forge pig containing .10 per cent or often more in sulphur. In the heating furnace the muck bar is exposed to the gases of combustion and a further absorption takes place. Samples of mill scale from different works gave an analysis of .17 per cent and .26 per cent for wrought iron scale, and .061 per cent and .084 per cent for steel scale. In the decarbonizing annealing of thin castings it is necessary to have a packing as low in sulphur as possible and free from foreign matter. A pitted surface will often result from poor packing caused both by the diffusion of sulphur and small particles of foreign matter becoming imbedded in the iron that builds up the casting. In the case of castings that are to be polished or plated, this pitted surface is objectionable, as it renders the finishing operations difficult. Iron ores very low in sulphur can be obtained, but the present high price of iron is almost prohibitive. Annealing in ore requires rather different treatment, as the ores are chemically more active and the castings lose, rather than gain, owing to oxidation of the iron. Laudig (Trans. Amer. Ins. Mining Eng.) speaks of this fact in connection with the reducibility of ores in a blast furnace, and has shown that there is a ride difference in the reducibility of apparently similar oxides of iron. The length of these test bars in these experiments was measured on an improvised scale. This was made by cutting a 2-inch micrometer in half and bolting each on an iron frame, so that at zero the distance was 11¾ inches. As the micrometer was graduated from 1 inch to 2 inches, we were thus enabled to read any variation between 11¾ inches and 12¾ inches.

*Prepared for the March meetings of the Foundrymen's Associations, held Wednesday evening, March 7.

Discussion by Dr. Moldenke.

In the meeting of the Pittsburg Foundrymen's Association, Wednesday evening, March 7, Dr. Moldenke contributed the following comments on Mr. Davis's paper:

Mr. Davis presents some interesting matter in his paper, and I depart from my usual custom of refraining from discussing "malleable," on account of the various statements made recently concerning it, which will in time react upon the manufacturer to his material disadvantage. The expansion taking place during anneal is well known and allowed for in making the patterns; but the fact that under certain condi-

tions there is an increase in weight is not generally known outside of those well posted in the trade. It may be taken as a general rule that the contraction of the chilling irons used for "malleable" is ¼-inch to the foot. In the anneal an expansion of ⅛-inch to the foot takes place, the net result being the ordinary contraction allowed for gray iron. Patterns are therefore made in the usual manner, the special art of the "malleable" pattern maker being shown in the gating, chill arrangements, etc.

The contraction and expansion in "malleable" are not regular by any means, as the results of thousands of measurements have shown me. The reasons would seem to lie in the great differences due to: 1, slight changes in the chemical composition; 2, casting temperature changes; 3, shrinkages in the interior of the work. A test bar of "malleable" which does not show some interior shrinkage planes at right angles to its length and is a *rara avis*. You will please note that I use the term "shrinkage" for the unsound portions produced in the casting during the act of setting, while the reduction in length is designated as the contraction; for just look at the expansion of cast iron under heat a moment. Even with the imperfect knowledge we have on the expansion of metals under high temperatures, we know that a piece of cast iron increases about 1-60 of its length in heating from ordinary temperatures to the melting point. Reverse this and we see that a casting left free to contract in the mold will lose roughly 1-5 inch to the foot. It would seem then that which is usually called shrinkage is a simple contraction due to cooling.

To return to the subjeect: The contraction in the "hard" casting may vary from a little over ⅛-inch to nearly 5 16-inch. In the anneal this may or may not be brought back to the exact ⅛-inch. A long malleable casting can therefore show some unexpected features. The remarkable change in the casting due to the annealing process will some day be more fully understood. My own observations have been that the removal of the carbon in the skin is but a small matter when compared with the interior change of combined carbon to what Prof. Ledebur has called "temper carbon" (temperguss=malleable casting). A malleable casting of the proper composition should contain no graphite strictly speaking. The carbon is not crystallized, but is a soft amorphous variety similar to lamp black. If caught in the first stages of formation it may be readily removed with a needle when under the microscope.

How the carbon leaves the skin of a casting during anneal is something we are not acquainted with sufficiently as yet, and in furnace iron but little leaves it anyhow. A piece, say, ½ inch thick has the full amount remaining in the center; though cupola iron, requiring a much higher annealing heat, will necessarily have the loss in carbon accentuated somewhat. I have always noticed that when a heavy piece of "malleable" has not annealed properly, there is also very little expansion—a fact easily verified by trying to anneal a heavy piece of cupola iron at furnace iron temperature. One interesting point may be stated here which shows that if the carbon is removed by outside agencies it can only be carbonic oxide with but very little carbonic acid. I have repeatedly found a thin layer of lamp black on partly annealed castings when so packed in air tight receptacles, removed from all oxidizing influences, that only the little air present in the first place could act upon them.

To sum up: The change from the dense iron carbides of the hard casting to the open malleableized structure after anneal means the exertion of a powerful expansive force creating inter-crystalline spaces for the disposal of the temper carbon which would otherwise have no place. The expansion of malleable is probably due to these forces and not to iron added from the scale.

I am inclined to take issue with Mr. Davis on what he calls the concretion of malleable castings. If he can really gain about 6 per cent of iron during the anneal he will make our gray iron founders envious, for he really recoups himself for the greater part of his melting loss. Now, that a casting can actually weigh more after the anneal than before is a fact; but I have always considered it an unfortunate one when I met it, for in my estimation the added weight is not due to iron welded on from the scale, but to the oxidation of the casting itself, which means weakness. A glance at Table 1 of the paper shows this. Why was only 0.10 per cent of iron (?) added to the second anneal of a piece which gained 60 times as much from the first? By the way, 6⅓ per cent added to the weight of a casting is quite an appreciable quantity. Too bad that the dimensions of the pieces are not given so that the added thickness might be calculated.

Now as to the next point of difference: I may as well state frankly that every carbon analysis of malleable castings which I have seen published is unreliable. I was once given a piece of malleable analyzed by two well known chemists one of whom found .27 total carbon, the other 3.99. Both results were incorrect, for one took his sample from the skin, the other from the center of the fracture. In fact, an absolutely correct analysis cannot be made, though it should approximate the truth very closely. I will explain what I mean, by one example. A piece of ⅝-inch "malleable," ends broken off, was placed in the shaper and 1-16-inch cuts taken off. The first cut ran 0.16 total carbon; the second 0.65 per cent; the next 1.84 per cent, the next 3.97 per cent, and the next 4.05 per cent. The hard casting contained 4.08 per cent total carbon. On the face of this, of what good is an analysis of "malleable" showing a total loss of carbon due to annealing unless the *whole of a sample bored through the test piece* is used for the determination? Boring a lot of holes, mixing the drillings, and selecting samples simply will not do. I am afraid, therefore, that the figures given by Mr. Davis incline toward too great a removal of carbon, and the assumption of a loss of 3.40 per cent is far too high a guess.

When Mr. Davis speaks of the diffusion of carbon in annealing I think he comes nearer the real truth of the process than he may be aware of. In my experience with over 100,000 tons of malleable castings I have gained a wholesome respect for oxygen, as you may have observed in my writings on gray iron. Just try to anneal a piece of gray iron in the regular process for "malleable" and note the beautiful banded "calico" structure of the rotten specimen of iron that comes out. Now, here is a good example of oxygen getting into and ruining a piece of iron with nearly 4 per cent carbon. Why did not the oxygen take the carbon and leave the iron alone? Well, it did not; and here I have always had a lurking suspicion that once oxygen got into iron it was mighty hard to get out again. What then becomes of the universally accepted theory that oxygen enters the malleable casting to remove its carbon? It always seemed to me that carbon diffusing out did have some chance, for when oxygen does get into a malleable casting we at once recognize its effect by the white crystalline rim of "burnt" malleable iron.

I heartily agree with Mr. Davis on the sulphur question, though I was seldom troubled with it, having a better grade of "scale" to deal with. His results would indicate that sulphur can readily infuse into the iron but cannot diffuse out, varying in this respect from Mr. Campbell's well known experiments on steel.

Mr. Davis's interesting paper shows us how little we really know about the internal economy of our beloved cast iron, and incidentally what a fascination it is to delve into the mysteries of even so simple-looking an article of our daily life.

WAGES in the Connellsville region were never so high as at the present time, and the recent advance given all classes of workers benefits a greater number of individuals than any similar advance in other industries. It is the fifth voluntary advance in wages since Feb. 10, 1894, the total increase since that time being 60 per cent to miners and 67 per cent to coke drawers. The dates are Feb. 15, 1894; April 1, 1895; Oct. 1, 1895; Jan. 1, 1896; April 29, 1899, and the present advance, effective March 1. The price of mining and loading coal was advanced from 78 cents per 100 bushels in 1894, to $1.25 per 100 bushels by the rate now in effect. Coke drawing was raised from 43 cents per 100 bushels charged, to 72 cents, the rate now paid, and other branches of labor were advanced in the same ratio.

A PARTY of 25 students of the Stevens Institute of Technology, Hoboken, N. J., have been in Pittsburg this week visiting the Westinghouse plants at Wilmerding and East Pittsburg, the Carnegie Steel Works at Homestead, Duquesne, and Braddock, and other plants in the Pittsburg district.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Youngstown Rivet Co., Youngstown, O., which by incorporation last week becomes the Mahoning Mfg. Co., is in the market for a milling machine, surface grinder, cold circular saw, drill press, 150 h. p. gas engine, conveyors, shafting and special machinery. The capital stock of the mahoning Mfg. Co. is $100,000 and the incorporators are H. B. Wick, John C. Wick, J. F. Bonnell, W. J. Sampson and Charles J. Wick. The object of the organization is the manufacture of rivets, spikes and railroad supplies Other lines of manufacture in iron and steel are also in contemplation. Extensive improvements in the plant are contemplated. At present the product is exclusively boiler, ship and structural rivets.

The Weatherly Foundry & Machine Co., Weatherly, Pa., capital $10,000, has been chartered at Harrisburg. The directors are: Elmer Warner, Wm. H. Koons, J. W. Lovatt, Fred. Bertolette, Jas. G. Eddie, Jos. R. Cassler and Jas. S. Kressley.

Avery Stamping Co., Cleveland, wants one or more second-hand heavy adjustable tilting presses, about 4,000 to 5,000 pounds; shaft at least four inches.

Box 34, Marion, O., wants bolt and nut machine to make one-quarter inch, three-eighths-inch, five-eighths inch and one-inch bolts and nuts.

"Hammers," care of the *Iron Age*, Fisher Building, Chicgo, Ill., wants four 50 pound (Bradley) upright cushion hammers, second-hand.

The Excelsior Coal Mining Co., Middlesborough, Ky., is in the market for second-hand 20 h. p. boiler and engine.

At Charleston, W. Va., the Charleston Foundry & Boiler Co. has been incorporated, with authorized capital of $50,000, by E. Polsue, E. C. Polsue, H. Barton, Sr., and Val Frauth.

D. Birney Neil has been elected president of the Columbus (O.) Malleable and Gray Iron Casting Co.; Charles A. Klie, vice-president; O. C. Klie, secretary and treasurer; and H. T. Irvin, general manager. The plant will be erected at Curtis and Lexington aves., and will be ready for occupancy May 1.

The Dauntless Burner & Gas Stove Co., Massillon, O., is in the market for a 10 h. p. gas engine belting, shafting, pulleys, small drill press, lathe swing, 14 inch.

Fires and Accidents:—

Fire caused considerable damage to the plant of the W. A. Jones Foundry & Machine Co., 53 to 59 South Jefferson st., Chicago, Feb. 25, as noted last week. The machine shop and power plant were destroyed, with loss of $10,000 to $12,000, insured, but the foundry was not damaged. The damage to the power plant caused the stopping of the foundry for a week. W. A. Jones left Chicago on a trip to Florida the night before the fire, to be gone several weeks. It is expected he will return earlier than he had contemplated and until he returns nothing will be done about refitting the machine shop. The company purchased the old plant of the Chicago Steel Co., on the North Side of Chicago, recently, and is fitting that up for a foundry and machine shop, with the intention, however, of continuing the shop on Jefferson st. in connection with the new place. It has been doing a large business lately, and the loss will be increased by the delay to orders in hand.

At Chester, Pa., the machine shop and rail cutting department of the Johnstone Railway Frog & Switch Co. was destroyed by fire Feb. 24. Planing and cutting machines were ruined. The loss is put at $35,000.

The Stowell Mfg. & Foundry Co.'s malleable plant at South Milwaukee, Wis., was burned Feb. 28. The loss is about $15,000, isured.

The extensive anvil plant of Hay, Budden & Co., Brooklyn, N. Y., was burned March 3. Loss, $80,000. The hydraulic plant, one of the most complete in the country, was destroyed.

New Construction:—

In addition to the locomotive erecting shop 200x749 feet planned for it by Wilson Bros. & Co., Drexel Bldg., Philadelphia, the Reading Railway contemplates the erection in the near future of a foundry, 130x500 feet; pattern shop, 60x200 feet; power and boiler house, 45x220 feet; blacksmith shop, 75x240 feet; forge shop, 75x300 feet; fine shop, 50x100 feet; boiler, machine and flange shop, 50x100 feet, and an office buiding.

The Penn Bridge Co., of Beaver Falls, Pa., has a contract for building a machine shop at the Mare Island Navy Yard, California.

The Pusey & Jones Co., of Wilmington, Del., has placed an order with the Schultz Bridge Co., of McKees Rocks, Pa., for the construction of a steel frame building.

John Dorlin, Philadelphia, has the contract for a brick brass foundry, 50x30 feet and two stories, for the Neafie & Levy Ship & Engine Co.

A Chattanooga, Tenn., dispatch says that new buildings and new machinery are to be added to the shops of the Cincinnati, New Orleans & Texas Pacific Railroad.

At Elyria, O., Geo. L. Weller and Chas. J. Crehore will erect a plant for the manufacture of steam drills, engines, etc.

The projected plant of the South Bend, (Ind.) Malleable Iron Co. includes four or five brick buildings from 60 to 100 feet wide and 150 to 350 feet long.

General Industrial Notes:—

The report in the daily newspapers of the closing down of all the mills of the Republic Iron & Steel Co. in Indiana is absolutely denied by Secretary S. J. Llewellyn, of the company. No mills were shut down, even for a day, and there has been no trouble at any of them. The reports had it that the mills were closed because of the State law requiring pay rolls to be paid weekly, when the company had been in the habit of paying every two weeks. As a matter of fact the men employed by the company are perfectly saitsfied with the present method of paying, and have not asked the company to change it. Mr. Llewellyn states that he does not expect any trouble on account of the law.

The Canton Rolling Mill Co., Canton, O., which is to be incorporated in the American Steel Sheet Co., has closed down and will be idle for a few weeks.

The Cuban Steel Ore Co., of Philadelphia, has placed an order with the Baldwin Locomotive Works for two six-wheel switching engines, weighing, in working order, 110,000 pounds each. These will go to the company's iron ore properties near Cherivico harbor, west of Santiago de Cuba.

There has been considerable interruption to the operation of the Alabama Steel & Shipbuilding Co.'s plant at Ensley, Ala., owing to trouble with the heating furnaces. It is expected that additional soaking pit furnaces will be provided.

The sale of the Troy Carriage Co.'s plant at Troy, O., set for Feb. 24 has been postponed to April 7.

The men employed at the coke ovens of the Cambria Steel Co., near Dunbar, Pa., have been given an advance in wages in accordance with the scale of the Frick Coke Co.

At a special meeting of the board of directors of the Pottstown Iron Co, of Pottstown, Pa., held March 1, the following officers were elected to serve for the ensuing year: Andrew Wheeler, president; Austin Heckscher, vice-president; W. H. Hiester, treasurer; Philip P. Chase, secretary.

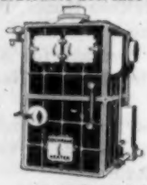
The Northern Engineering Works, Detroit, crane builders, report a large number of orders for electirc traveling cranes, including two 5-motor travelers, of 65-foot span, for special steel plant work. This company is also making a lot of electric jib cranes. Improvements and additions to the plant, to make room for increasing business, are contemplated.

The Wefugo Co., of Cincinnati, reports that in the last six months it has furnished water softening plants to the following concerns: Niles Tool Works, Hamilton, O., capacity 96,000 gallons; John Ebner Ice Co., Vincennes, Ind., 33,600; Carnegie Steel Co., Lucy Furnaces, Pittsburg, 576,000; Carnegie Steel Co., Upper Union Mills, Pittsburg, 480,000; Youngstown Steel Co., Youngstown, O., 240,000; Floy & Carpenter, Columbia Hotel, at Nassau, B. I., 48,000; Floy & Carpenter, two pressure filters; St. Louis Smelting & Refining Co., Desloge, Mo., 86,400; Dayton Union Depot, Dayton, O., 19 200; Peru Steel Casting Co., Peru, Ind., 84,000; Denison Crystal Ice Co., Denison, Tex, 19,200; U. S. Playing Card Co., Norwood, O., 96,000; Chicago & Alton R. R., Joliet, Ill., 100,000; Chicago & Alton R. R., Bloomington, Ill., 400,000; Westinghouse, Church, Kerr & Co., Frement, O., 120,000;

Cochrane Feed-Water Heaters.

Running only ten hours a day, in a month there will pass through a 100 H. P. boiler, evaporating 30 lbs. of water per horse power per hour, over 400 tons of water.

If we assume that there are 20 grains per gallon of scale-forming matter present in the supply that is being used, this 100 H. P. boiler will have to digest, work off, or stow away, over 300 lbs of solid matter. That doesn't seem very much—only two or three wheelbarrow loads, but even a third of this quantity is sufficient, when distributed over the heating surfaces, to cause a very considerable decrease in the efficiency of the boiler feed as regards capacity or economy. It also costs money to remove scale.



If you use a COCHRANE FEED-WATER HEATER PURIFIER and you will save all of the exhaust condensed in doing the heating:

This, under ordinary conditions, amounts to about 1-6 of the total supply required for the boilers, or say, in the example given above, over 66 tons of water per month, and there's not a particle of scale-forming matter in these 66 tons!

In consequence, it is only necessary for this boiler to handle about 334 tons of cold, impure water, and only 250 lbs. of solid matter per month. If the impurities consist of mud, and the carbonates of lime and magnesia, the *Cochrane Heater* will remove the major portion of these.

So that, with the right kind of a feed-water heater, you can automatically, and without any extra expense, improve the condition of your boiler feed supply, no matter how bad it is.

The proposition is worth considering.

HARRISON SAFETY BOILER WORKS, *Clearfield and Seventeenth Streets, PHILADELPHIA, PA.*

also two filters for Nassau, B. I., two for Red Bluff, Cal., and one for Atlantic City, N. J.

The Tennessee Coal, Iron & Railroad Co. confirms the report that it has purchased the Bessemer (Ala.) rolling mill. The plant is practically in running order and no plans for improvements are announced as yet.

The Virginia Iron, Coal & Coke Co., has awarded the contract for the remodeling of its plant at Middlesboro, Ky., including the building of two new soaking pit furnaces and the remodeling of seven 25-ton open-hearth furnaces, to Edward E. Erikson, consulting engineer, Conestoga Building, Pittsburg.

The Portage Lake (Mich.) Foundry & Machine Co. is rebuilding its foundry that was practically destroyed by fire in January.

The Frankford Forge Co., of Philadelphia, has taken an option on land at Eddystone, near Chester, Pa., and it is reported will build a plant adjoining that to be erected by the Gruson Iron Works.

At Toronto, Ont., the Toronto Electric Light Co. will erect a machine and repair shops, and later on a new power house.

The American Machinery & Trading Co. has established a main office in the Bowling Green Building, New York City, with branch offices in the largest cities in the United States, also in all foreign countries, with a large corps of traveling salesmen, and correspondents, buyers of machinery, hardware, etc. It solicits exclusive agencies and special prices from manufacturers of all kinds of machinery in this country, with a view to handling it to the best advantage on account of special facilities for placing orders. Mill owners, contractors and purchasing agents of power and electric light plants are requested to correspond with this company.

The Bridgeport (Ala.) Pipe Works, owned by the United States Cast Iron Pipe & Foundry Co., is to be started up.

The Rand Drill Co. has taken a contract for a compressor for the Hartford mine near Negaunee, Mich., also for compressors for the Quincy Mining Co., and the Adventure Consolidated Mining Co., in the copper country.

The conclusion of the deal for the purchase of the steel plant at Superior and the car works and structural mill at Duluth by the Searles syndicate, of New York, is said to be postponed for a few weeks.

The Youngstown Forging Co., Youngstown, O., has installed a large steam hammer, built by Bement, Miles & Co. It is 15 feet high and weighs 20 tons. The die surface of the hammer is 11x24 inches, and the stroke is 48 inches, with a capacity of 120 blows per minute. The company has on hand contracts for large shafts, for piston rods, bottom plates, housing screws, etc. Recent orders are from the Lloyd Booth Co., the American Tin Plate Co., and the Virginia Iron, Coal & Coke Co.

The Pittsburg District:—

The A. Garrison Foundry Co., Pittsburg, has just completed the first three high universal plate mill ever constructed. It is a 28-inch mill and was built for the Lukens Iron & Steel Co., Coatesville, Pa. The mill was specially designed by the foundry company and others of a similar pattern will be turned out by them.

Laughlin & Co., Ltd., Pittsburg, will build a two-story 11-room storage house and laboratory near their plant. Its cost is estimated at $15,000.

The Fisher Foundry & Machine Co., Pittsburg, will add a machine shop to its present equipment. It will be two stories in height, and will be built of brick and iron. Cost, $3,000.

Jones & Laughlins, Ltd., Pittsburg, will build a two-story iron-clad extension to their office building and warehouse, the cost of which will be about $7,000.

The Pittsburg Steel Hoop Co. rolled its first billets this week at its newly erected plant at Glassport, Pa. The 8-inch and 20-inch mills will be put in operation within the next 10 days.

It is reported that Pittsburg and Baltimore capitalists have organized the Pittsburg-Fayette Coal & Coke Co., which expects to develop about 20,000 acres of coal land near Morgantown, W. Va.

The Westinghouse Electric & Mfg. Co., Pittsburg, has been awarded a large contract for machinery from the Electrical Lead Reduction Co., of Niagara Falls.

The contract for the rebuilding of the plant of the Duquesne Mfg. Co., Pittsburg, which was destroyed by fire about a month ago, was last week awarded to William Waite & Son. The new structure will cost about $50,000.

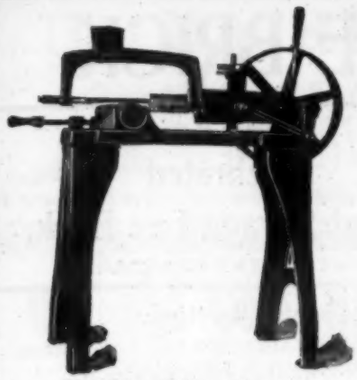
J. A. Tuthill, of Honolulu, Hawaiian Islands, was in Pittsburg last week, placing orders for steel rails and track material, and negotiating the purchase of several small locomotives. Mr. Tuthill is the junior partner of the firm of W. C. Gregg & Co., contractors, who are building several small roads on these islands.

The four hot mills at the Washington, Pa., plant of the American Tin Plate Co. were put in operation last week,

MALLEABLE

HIGH GRADE CASTINGS. QUICK DELIVERIES.

BUHL MALLEABLE CO., **Detroit, Mich.**



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Pneumatic Tools,
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Our hammers are especially suited for machinists' work. No vibration and great speed on cast iron and steel.

Shop Saws

For cutting tool steel and all softer metals. Equipped with gravity or automatic feed.

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and the other departments will be put on as fast as the material is ready for them.

THE MACHINING OF WORK.

The oldest example of economizing the machining of work by duplicating tools is found in the duplex type of lathe, in which two, three, four and even six tools may be operated at one time. In discussing this subject in *Cassier's Magazine*, Joseph Horner says: "Similar illustrations occur in the employment of two tools in planing and in slotting machines; in the carrying on of two or three sets of milling operations at one time, as on some of the plano-millers; in the boring of two or more cylinders simultaneously; in the cutting of several rack teeth at once on several adjacent racks; in the Eberhardt system of cutters for spur wheels, by which two teeth and upwards are cut at one time; and also in the numerous multiple drilling machines.

The machining of work is also economized in an equal extent by operations which are not simultaneous, but in which a number of tools are brought round in quick succession, as in turret practice, and in which also time is saved which is otherwise occupied in resetting work and adjusting tools. Time is also saved by the use of stops, by which the traverse of each tool in the turret is limited and arrested without any care on the part of the attendant. In the modern turret, instead of one stop doing duty for all the tools, which involved careful setting of every tool in relation to the stop, every tool has itsown independent shop, adjusted to accommodate the tool.

Facility for rapid changing of feeds is another late development which is conducive to rapidity of output. The old devices of altering change gears, or of shifting feed belts, are now recognized as being too slow in operation for the smaller lathes and milling machines. A good many firms, therefore, now embody in their tools devices to change feeds rapidly. The principal among them is the nest of gears, having movable pinions of different sizes, which are slid into gear with fixed pinions by means of a cotter or pin in a sliding rod, which pin drives in the loose pinion through the bosses,—a device put on many horizontal and vertical lathes. In other cases pinions are hinged, to be thrown over into gear and there locked. Another rather common device is the Sellers friction discs, in which the radial position of the inner solid disc to the outer divided pair regulates the feed. Then there is the bowl type of disc, in which the radial position of the friction roller to the large disc determines rate of feed. These are well known, but their rapidly increasing application to machines other than those for which they were originally designed is a feature which makes for economical working.

The Akron Machine Co., Akron, O., will make extensive improvements and enlargements, it is announced, and the capital of $50,000 will be nearly doubled. At the recent election of officers, F. E. Smith was made president, succeeding F. H. Holton; A. W. Hull, formerly connected with the Akron Iron & Steel Co., secretary and treasurer, and M. J. Gibbs, general manager.

The new furnace at the Ohio Works of the National Steel Co., at Youngstown, O., has been in operation three weeks, and its output is gradually approaching the 600-ton mark.

The work of removing the machinery of the Damascus Steel Co.'s plant, Pittsburg, to Parkersburg, W. Va., has begun. There will be two buildings—the forge shop, and the rolling mill 60x300 feet. The Fulton Tool Co., Canal Fulton, O., will also locate at Parkersburg and will have two buildings, one 150x50 feet and the other 200x50. The Crown Wire Co., Pittsburg, will have one building, the dimensions of which

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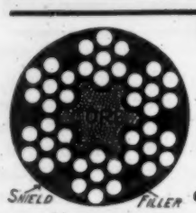

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will be 30x100 feet. The Fulton Tool & Mfg. Co. will manufacture pit cars and railroad tools, while the Crown Wire Co.'s product will consist largely of steel wire and dies. In order to get the three plants to locate in Parkersburg a bonus of 60 acres of land was given.

THE National Cable & Wire Co., Pittsburg, will apply for a charter March 24. The applicants are David Carlin, C. C. Henry, Andrew Johnston, J. O. Campbell and William J. Brennan. The concern will manufacture insulated wire from iron and steel.

The Buckeye Engine Co., Salem, O., has a contract from the Sharon Steel Co., Sharon, Pa., for an 800 horse-power tandem and four 1,600 horse-power cross compound condensing engines.

The Means-Fulton Iron Co., Birmingham, Ala., has received a contract for building three stoves for the furnaces of the Republic Iron & Steel Co. at Thomas, Ala. They will be 20 feet in diameter and 85 feet high.

Hurd, Davis & Co., Ferguson Block, Pittsburg, have been appointed sole agents in the Pittsburg district for the sale of Bessemer gas engines, made by the Bessemer Gas Engine Co., Grove City, Pa.

THE Oliver Iron & Steel Co., Pittsburg, last week let a contract for the erection of a $150,000 addition to its large

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works. It will be devoted exclusively to the manufacture of wagon material.

On account of the great rush of coal and coke from the Connellsville region and the surrounding territory, the Pennsylvania Railroad has begun the construction of large freight yards on the Southwest Division, which runs from Fairchance to the main line at Greensburg. The yards are to extend from Fosterville, which is four miles from Greensburg, to Youngwood, a distance of two miles. There will be 21 tracks. A great deal of grading will be required, and the estimated cost is about $500,000. The use of the new yards will greatly facilitate the handling of coal and coke.

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For information about reduced fares, through time, and other particulars regarding Home-Seekers' Excursions to the South and West apply to Pennsylvania Lines Ticket Agents.

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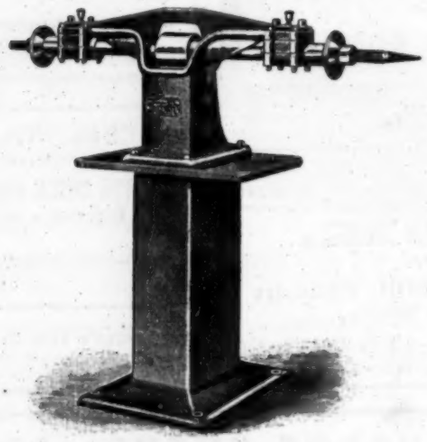

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South Bound.			Central Standard.		North Bound.	
15	13	11	Lorain Branch	12	14	16
P.M.	P.M	A.M.	LV AR.	A.M.	A.M.	P.M.
4:25	1 05	7:05	Lorain	9:10	11:30	6 37
4:40	1:20	7:20	Elyria.....	8:54	11:16	6:23
4:56	1:38	7:41	Grafton	8:35	10:59	6 05
5:15	1:57	8.00	Lester.....	8:15	10:41	5:47
3	3	1	Main Line	2	4	6
4:40	1 00	7:10	Cleveland	9:10	11:40	6:40
4:54	1:16	7:24	Brooklyn	8:54	11:24	6:26
5:45	2:02	8:14	Lester.....	8:10	10:40	5:40
5:56	2:11	8:23	Medina.....	7:55	10:30	5:26
6:19	2:30	8:43	Seville.....	7:33	10:10	5:05
6:26	2:36	8:49	Sterling.....	7:27	10:04	4:59
6:48	2:58	9.11	Warwick.....	7:05	9:41	4:35
6:56	3:05	9:18	Canal Fulton	6:58	9:35	4:28
7:16	3:23	9:32	Massillon	6:40	9:18	4:11
7:31	3:40	9:58	Justus.....	6:24	9:03	3:55
8:01	4:11	10:26	Canal Dover.	5:55	8:31	3:26
8.08	4:18	10:33	New Philade	5:48	8:27	3:18
8:25	4:35	10:50	Uhrichsville	5:30	8:10	3:00
	4:50	11:15	D. " A.	.....	8:10	3:00
	6:50	1:15	Bridgeport ...	.....	6:10	1:00
	7:05	.....	Bellaire.....	.....	5:55	.....
	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

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Baltimore and Washington	* 2:10 pm	*11:30 am
Alliance and Pittsburgh	* 2:10 pm	*11:30 am
Ravenna and Alliance	* 5:10 pm	* 8:35 am
Philadelphia and New York	*11:10 pm	* 4:30 am
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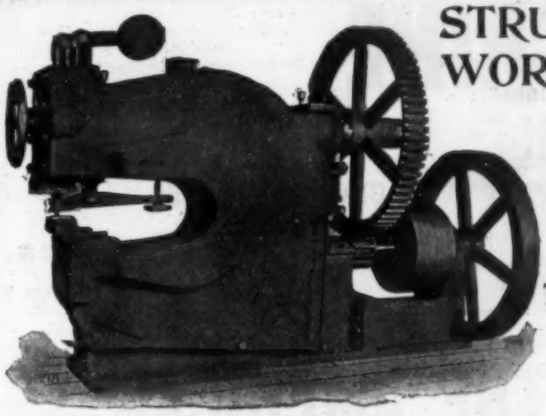

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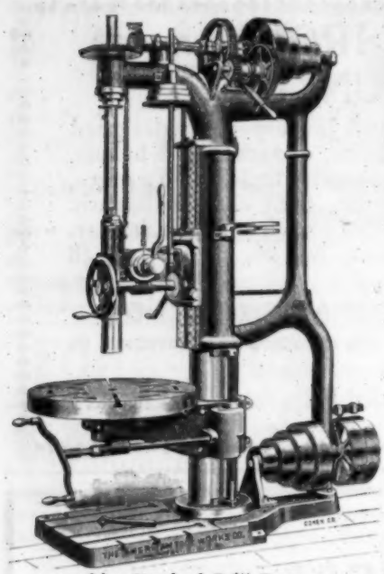

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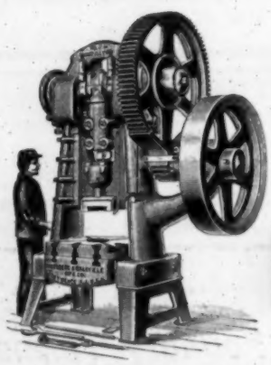

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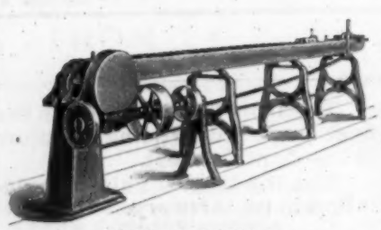

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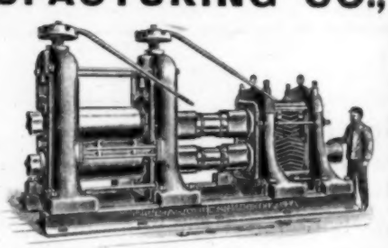

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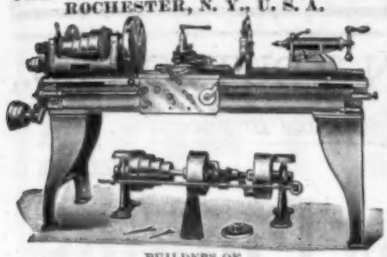

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Akron, Canton & Chicago.....	*8:15 A M	*6:35 P M
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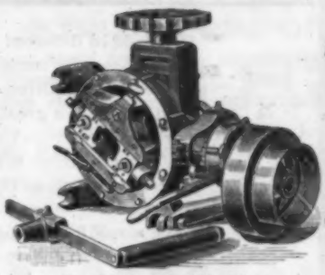

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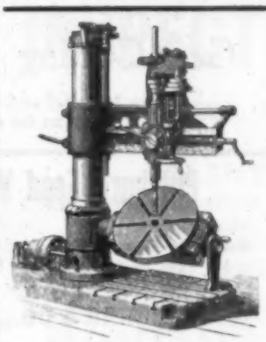

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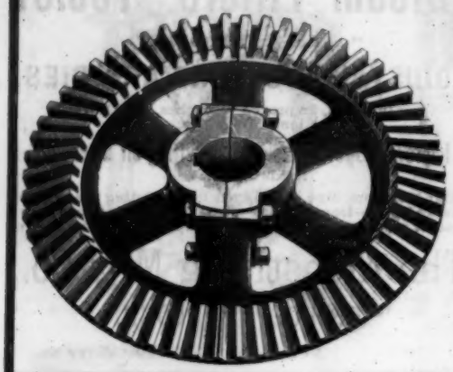

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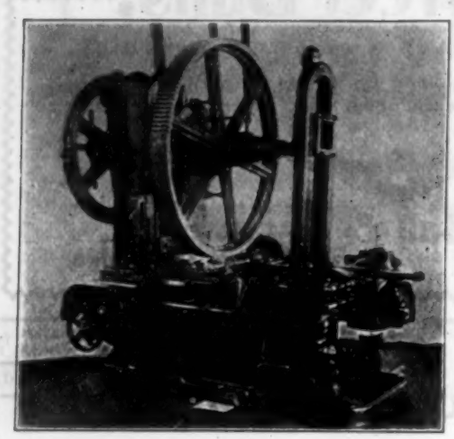

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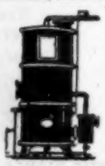

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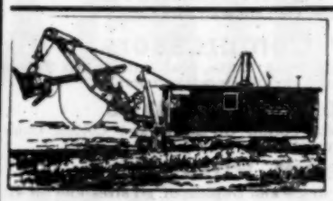

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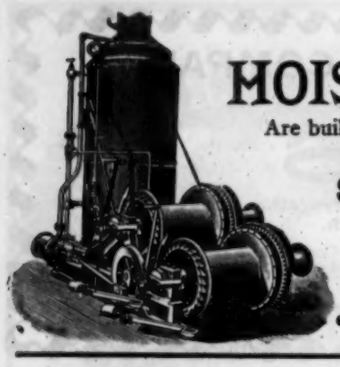

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The Iron Trade Review is an increasingly valuable medium, through which to sell equipments to machine shop and foundries.

AN OPEN LETTER.

TO THE EDITOR OF THE IRON TRADE REVIEW:

Doubtless many of your readers are users of nuts, and if so have experienced the common difficulty of keeping them tight on the bolts.

No matter how tight they are when first put on, they soon work loose and rattle off where there is any jar or vibration. In fact this is the acknowledged and almost universal complaint, as is eloquently proclaimed by the various nut-locks, jam-nuts, spring-washers, keys, etc., on the market, gotten up in the vain attempt to fasten a nut securely and permanently. Experience has proven most of these wholly inefficient after a short time, and that all of them, without exception add greatly to the cost of the nut.

In view of the above, we believe that your readers will be interested to learn of a thoroughly practical and successful self-locking nut, that locks itself on the bolt wherever placed and that effectually and completely overcomes the difficulties presented above.

This is our Elastic Self-locking Steel Nut, and we have thought best to take this space in your valuable paper to tell your readers something about this wonderful nut that has proven so simple, efficient and inexpensive, that it has within the last few years fairly supplanted the use of the common nut where nuts are liable to work loose. On that account it is now used regularly by many of the largest Railroads, Bridge Builders, Machinery Manufacturers, Engineers, Car Builders, etc., of the country. The Elastic Nut owes its self-locking feature to its peculiar manufacture, as it is made in an entirely different manner from the ordinary nut. It is made of a flat bar or section of steel bent around into a ring, and then this ring is pressed into the shape of a nut having a lapped opening on the side. It is then tapped or threaded slightly smaller than the standard bolt, so that when wrenched on, the nut is distended a trifle and grips the bolt which holds it from ever working loose like the ordinary nut.

Being made in this manner and of steel, the Elastic Nut is always stronger than the bolt, and if put down to breaking strain will invariably break the bolt without injuring the nut in the least. In fact, as one customer puts it, "It makes a fastening on the thread end of the bolt as strong, permanent and secure as is the bolt head on the other," and at a much less cost than any other method. Also for use where a self-locking nut is not required, by simply tapping them full standard instead of scant, they are then practically the common nut and many large concerns whose work does not require a self-locking nut, are using them in this way.

These nuts though much superior in every way to the ordinary iron nut, can be furnished for considerably less, as the special method of manufacture saves entirely the ordinary scrap waste of about forty per cent. We are therefore able to furnish users of nuts with the best nut on the market (either self-locking or not as desired) and at a less price than the ordinary nut. We make these nuts in sizes from ⅝ in. up to 1¼ in. both inclusive and can furnish them either rough for ordinary railroad and car work or semi-finished and finished for finer machine work.

As previously stated, many of the largest concerns are using these nuts, and from our list of orders we mention, New York Central & Hudson River Ry., Haskell & Barker Car Co., Pennsylvania Steel Co., The Edward P. Allis Co., Fraser & Chalmers, The Atlantic Works, Link Belt Engineering Co., National Machinery Co., etc.

We issue a little booklet giving additional information that we will be glad to send to any of your readers who will write for it, and shall also be glad to send samples and prices on request. Hoping that we may hear from them liberally, we are,

Yours truly,

NATIONAL ELASTIC NUT CO.,
MILWAUKEE, WIS.,
Per T. L. Paine, Manager.

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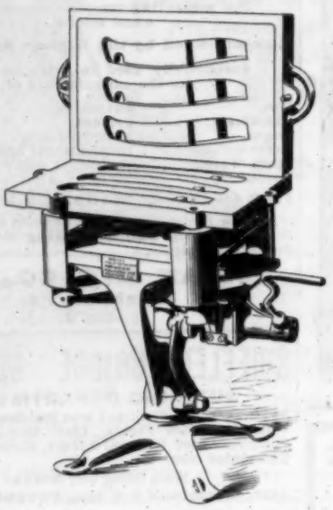

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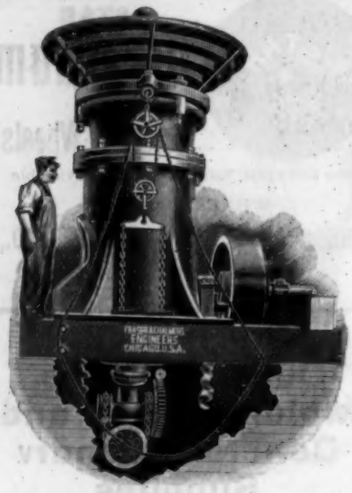

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Carnegie Steel Company, Ltd., Rankin (Carrie)	2	700	Double.
Carnegie Steel Company, Ltd., Pittsburg (Lucy)	2	800	Double.
Struthers Furnace Company, Struthers, O.	1	300	Single.
Laughlin & Co., Ltd., Pittsburg, Pa. (Eliza)	5	2,000	Double (2).
Oliver & Snyder Steel Company, Pittsburg, Pa. (Edith)	1	400	Double.
Oliver & Snyder Steel Company, New Castle, Pa. (Rosena)	1	500	Double.
Shenango Valley Steel Company, New Castle, Pa.	2	800	Double.
Bellaire Steel Company, Bellaire, O.	2	700	Double.
Lebanon Furnaces, Lebanon, O.	2	500	Double.
Tennessee Coal, Iron & Railroad Company, Ensley, Ala.	4	800	Double.
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American Steel & Wire Co.	7	3,000	Double (3).
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For particulars write
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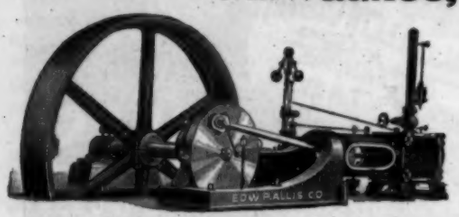

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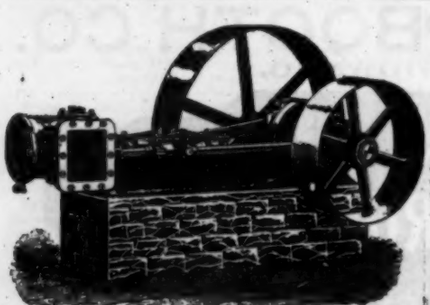

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The Jeffrey Mfg. Co., Columbus, O.

BELT DRESSING—
The Ironsides Co., Columbus, O.

BELT LACING—
The Bristol Co., Waterbury, Conn.

BLACKSMITH AND CARRIAGE SUPPLIES—
C. H. Besly & Co., Chicago, Ill.

BLAST FURNACE WORK—
Enterprise Boiler Co., Youngstown, O.
Excelsior Iron Works Co., Cleveland, O.
Meehan Boiler & Construction Co., Lowellville, Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
The United Boiler Co., Girard, O.
West Penn Foundry & Machine Co., Avonmore, Pa

BLOWING ENGINES—
Southwark Foundry & Machine Co., Philadelphia, Pa.
Edward P. Allis Co., Milwaukee, Wis.

BOILERS AND BOILER ATTACHMENTS—
Hyde Bros. & Co., Pittsburg, Pa.
The Wm. B. Pollock Co., Youngstown, O.
Cahall Sales Department, Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
Hooven, Owens & Rentschler Co., Hamilton, O.
Harrison Safety Boiler Works Philadelphia.
Meehan Boiler & Construction Co., Lowellville, O
Wm. Cramp & Sons, Philadelphia, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.
James Bonar & Co., Pittsburgh, Pa.
W. P. Davis Machine Co., Rochester, N. Y.
The United Boiler Co., Girard, O,
Reinhold Bettermann, Johnstown, Pa.

BOILER COVERING—
C. H. Besly & Co,, Chicago, Ill.

BOILER COMPOUNDS—
The Ironsides Company, Columbus, O.

BUYERS' DIRECTORY.

BOILER FLUE PLUGS—
Reinhold Bettermann, Johnstown, Pa.

BOILER TUBES—
S. Fix Sons, Cleveland, O.
National Tube Co., Pittsburg, Pa.

BOLTS AND NUTS—
L. K. Hirsch, Chicago, Ill.
Upson Nut Co., Cleveland, O.
National Elastic Nut Co., Milwaukee, Wis.

BOLT CUTTERS—
American Tool Works Co., Cincinnati, O.

BORING AND TURNING MILLS—
H. Bickford, Lakeport, N. H.
U. Baird Machinery Co., Pittsburg, Pa.
Baush & Harris Machine Tool Co., Springfield, Mass.
Bickford Drill and Tool Co., Cincinnati, O.
American Tool Works Co., Cincinnati, O.

BOX CAR UNLOADER—
The Jeffrey Mfg. Co., Columbus, O.

BRASS CASTINGS—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.

BRIDGES—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Shiffler Bridge Co., Pittsburg.

BUILDINGS (STEEL FRAME)—
Illinois Steel Co., Chicago, Ill.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.

BUCKETS AND DERRICKS—
Excelsior Iron Works Co., Cleveland, O.

CABLEWAYS—
Lidgewood Mfg Co., New York City.
Waterbury Rope Co., New York City.

CARS—
L. K. Hirsch, Chicago, Ill.
The Pressed Steel Car Co., Pittsburg, Pa.

CAR UNLOADERS—
Excelsior Iron Works Co., Cleveland, O.

CAR WHEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

CARRYING TONGS—
Vulcan Mfg. Co., Pittsburg, Pa.

CASE HARDENING MATERIALS—
American Carburising Co., New York City.

CASTINGS—
Seaman-Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
Macbeth & Co., Cleveland, O.
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Lorain Foundry Co., Lorain, O.
West Penn Foundry & Machine Co., Avonmore, Pa

CASTINGS (ALUMINUM)
J. J. Ryan & Co., Chicago, Ill.

CASTINGS (BRASS)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co Lorain. O.

CASTINGS (BRONZE)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.

CASTINGS (MALLEABLE)—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

CASTINGS (Steel)—
Hercules Steel Casting Co., Harvey, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.

CEMENT—
Garden City Sand Co., Chicago, Ill.
Reed F. Blair & Co., Pittsburg, Pa.

CHAIN BELTING—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
Buhl Malleable Co., Detroit, Mich.

CHANNELERS—
The Ingersoll-Sergeant Drill Co., New York.

CHEMISTS—
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
John T. Jones & Co., Chicago, Ill.
Cremer & Bicknell, Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
We Fu Go Co. Cincinnati, O.

CHILLED AND SAND ROLLS—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Riverside Foundry Co., Cleveland, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
The Lloyd Booth Co., Youngstown, O.
West Penn Foundry & Machine Co., Avonmore, Pa

COAL CUTTERS—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.

COAL SCREENS—
Hendrick Mfg. Co., Carbondale, Pa.
Robt. Aitchinson Per. Metal Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

COAL AND COKE—
M. A. Hanna & Co., Cleveland, O.
Rogers, Brown & Co., Cincinnati, O
Reed F. Blair & Co., Pittsburg, Pa.
Pickand, Brown & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
McKeefrey & Co., Leetonia, O.
Pickands, Mather & Co., Cleveland, O.
J. H. Hillman & Son, Pittsburg, Pa.

COAL MINING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
Webster Camp & Lane Machine Co., Akron, O.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSED AIR SHOP TOOLS—
Clayton Air Compressor Works, New York City.
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Q & C Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
W. J. Schaefer & Co., New York City.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

CONVEYORS—
Jeffrey Mfg. Co., Columbus, O.
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.

CRANES—
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Crane & Car Co., Cleveland, O.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co, Harvey, Ill.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co, Youngstown, O.

CUTTER AND REAMING GRINDERS—
American Tool Works Co., Cincinnati, O.

DIES—
Mossberg & Granville Mfg. Co., Providence, R. I.
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, O.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield, Mass.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O
Buhl Malleable Co., Detroit, Mich.
Excelsior Iron Works Co., Cleveland, O.

EMERY AND CORUNDUM WHEELS—
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.
Reinhold Bettermann, Johnstown, Pa.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas. Taylor's Sons Co. Cincinnati, O.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLUE PLUGS—
Reinhold Betterman, Johnstown, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Joseph Dyson & Sons, Cleveland, O.
Frankford Steel & Forging Co., Philadelphia, Pa.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Excelsior Iron Works Co., Cleveland, O.

Macbeth & Co., Cleveland, O.
Vulcan Foundry & Machine Co., New Castle, Pa

FOUNDRY EQUIPMENT.
Tabor Mfg. Co., Elizabeth, N. J.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.
Maywood Foundry & Machine Co., Chicago, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
Thos. Furlow & Son, Philadelphia, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co Harvey, Ill.
Cleveland Facing Mill Co., Cleveland. O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes. Strachan & Co., Detroit, Mich.
Newport Sand Bank Co., Newport, Ky.
Maywood Foundry & Machine Co., Chicago, Ill.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago. Ill.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Nazel & Bassett, Philadelphia, Pa.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.
Cleveland Punch & Shear Wks. Co., Cleveland, O

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
Wefugo Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co. New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

HOISTING MACHINERY—
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co. New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
K. H. Stroud & Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg Co., Canton, O.
Ætna Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co. Cleveland. O.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co ,Cleveland,O.
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago. Ill.
U. Baird Machinery Co., Pittsburg. Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
American Machinery & Trading Co., N. Y. City.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co , Youngstown, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg. Pa.
Bickford Drill & Tool Co., Cincinnati. O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

LUBRICANTS—
The Ironsides Co., Columbus, O.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
American Machinery & Trading Co., N. Y. City.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City. Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co.,Cleveland,O.
Nazel & Bassett, Philadelphia, Pa.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANILLA ROPE COATING—
The Ironsides Co., Columbus, O.

MANUFACTURING CHEMISTS—
Wefugo Co., Cincinnati. O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Champion Iron & Steel Co , Muskegon, Mich.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Cabeen Co., Philadelphia, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co. Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co , Cleveland, O.

MILL CASTINGS—
Vulcan Foundry & Machine Co., New Castle, Pa.
Schuykill Iron & Steel Co., Philadelphia, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co , New Yotk City.
Exeter Machine Works, Pittson, Pa
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co . Cleveland, O.
Wm. B. Pollock Co., Youngstown, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.
Maywood Foundry & Machine Co., Chicago, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co.,Cleveland,O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS (Self Locking)—
National Elastic Nut Co., Milwaukee, Wis.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.
National Elastic Nut Co., Milwaukee, Wis.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
Rockwell Engineering Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago. Ill.
James Bonar & Co., Pittsburg, Pa

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
American Tool Works Co., Cincinnati, O.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Hendrick Mfg. Co., Carbondale, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
The Ironsides Co., Columbus, O.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland O
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Cabeen Co., Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,
J. H. Hillman & Son, Pittsburg, Pa.

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa
Wm. B. Pollock Co., Youngstown, O.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chcago, Ill.
Illinois Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
Q & C Co., Chicago, Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.
Mossberg & Granville Mfg. Co., Providence, R.I.
American Machinery & Trading Co., N. Y. City.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Cleveland Punch & Shear Wks. Co., Cleveland, C.
R. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
R. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O
Mossberg & Granville Mfg. Co., Providence, R.I.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & R. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
R. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass
American Tool Works Co., Cincinnati, O.

RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.

RAW HIDE GEARS—
Nasel & Bassett, Philadelphia, Pa.

RELAYING RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa.

ROLLER BEARINGS—
Mossberg & Granville Mfg. Co., Providence, R.I.

ROLLING MILLS—
Mossberg & Granville Mfg. Co., Providence, R.I.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
The Lloyd Booth Co., Youngstown, O.
Vulcan Foundry & Machine Co., New Castle, Pa.
Mossberg & Granville Mfg Co., Providence, R.I.
West Penn Foundry & Machine Co., Avonmore, Pa.

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

ROPE AND CORDAGE—
Waterbury Rope Co., New York City.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.

SECOND-HAND MACHINERY—
L. K. Hirsch Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.
American Machinery & Trading Co., N. Y. City.

SENSITIVE DRILLS—
American Tool Works Co., Cincinnati, O.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
James Bonar & Co., Pittsburg, Pa.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.

SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPIKES—
L. K. Hirsch, Chicago, Ill.

SPECIAL MACHINERY—
Cleveland Punch & Shear Wks. Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
Avery Stamping Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Q & C Co., Chicago, Ill
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
R. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.
Nasel & Bassett, Philadelphia, Pa.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co., Chicago Ill.

STEAM PACKING—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Hall Steam Pump Co., Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa,

STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

STEAM SPECIALTIES—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

STEEL—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

STEEL BALLS—
Cleveland Ball & Screw Co., Cleveland, O.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co. Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel & Wire Co., Chicago, Ill.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
National Steel Co., Chicago, Ill.
Bethlehem Steel Co. South Bethlehem, Pa.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
Hercules Steel Casting Co., Harvey, Ill.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

TANKS—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
The United Boiler Co., Girard, O.

TANK CARS—
The Wm. B. Pollock Co., Youngstown, O

TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

TIN AND TERNE PLATES—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, New York City.

TIN PLATE MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa.

TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

TRAMWAY EQUIPMENT—
Whiting Foundry Equipment Co., Harvey, Ill.

TRANSMISSION MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
W. A. Jones Foundry & Machine Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

TROLLEY TRACKS—
Whiting Foundry Equipment Co., Harvey, Ill.
Northern Engineering Works, Detroit, Mich.

TRUCKS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TUBES—
National Tube Co., Pittsburg, Pa.
S. Fix' Sons, Cleveland, O.

TUBE WELDING—
S. Fix Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TURNBUCKLES—
Republic Iron & Steel Co., Chicago, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.

TWIST DRILLS—
C. H. Besly & Co., Chicago. Ill.

TWIST DRILL CASES—
Vulcan Mfg. Co., Pittsburg, Pa.

VALVES—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Manning, Maxwell & Moore, New York City.
James Bonar & Co, Pittsburg, Pa.

WASHERS—
Avery Stamping Co., Cleveland, O.

WATER SOFTENING PLANTS—
Wefugo Co., Cincinnati, O.

WIRE—
American Steel & Wire Co., Chicago, Ill.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Company, Columbus, O.

WIRE MACHINERY—
S. W. Goodyear, Waterbury, Conn.
Mossberg & Granville Mfg. Co., Providence, R.I.

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE—
Waterbury Pope Co., New York City.

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.

WIRE ROPE FILLING—
The Ironsides Company, Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.

WROUGHT PIPE—
National Tube Co., Pittsburg, Pa.

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Stroud & Co., E. H	2
Struthers Iron & Steel Co	1-33
*Superior Charcoal Iron Co	27
Swarts Metal Refining Co	1
Tabor Mfg Co	37
Taylor's Sons Co., Chas	25
Textor, O	2
Tod, Stambaugh & Co	33
Tod, Wm. & Co	46
Torbert & Peckham	44
Totten & Hogg Iron & Steel Foundry Co	45
Trethewey & Co., Ltd., Samuel	38
Union Mining Co	24
United Boiler Co	35
Upson Nut Co	1
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Vermillion Pine & Iron Land Co	52
Vulcan Foundry & Machine Co	37
Vulcan Mfg. Co	35
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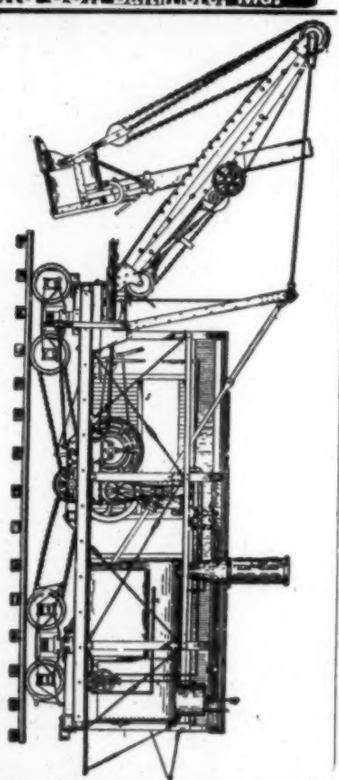

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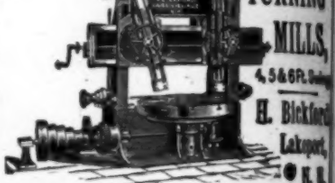

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